

Specifications Guide

Agilent Technologies ESA-L Series Spectrum Analyzers

This manual provides documentation for the following instruments:

ESA-L Series

E4403B (9 kHz – 3.0 GHz)
E4408B (9 kHz – 26.5 GHz)
E4411B (9 kHz – 1.5 GHz)



Manufacturing Part Number: E4403-90036
Supersedes: E4403-90032

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The following safety symbols are used throughout this manual. Familiarize yourself with the symbols and their meaning before operating this instrument.

| | |
|----------------|--|
| WARNING | <i>Warning</i> denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met. |
|----------------|--|

| | |
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| WARNING | This is a Safety Class 1 Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protected earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited. |
|----------------|---|

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|----------------|---|
| WARNING | If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only. |
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| | |
|----------------|--|
| CAUTION | <i>Caution</i> denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met. |
|----------------|--|

| | |
|----------------|--|
| CAUTION | Always use the three-prong ac power cord supplied with this product. Failure to ensure adequate earth grounding by not using this cord may cause product damage. |
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| | |
|----------------|---|
| CAUTION | This instrument has autoranging line voltage input, be sure the supply voltage is within the specified range. |
|----------------|---|

Warranty

This Agilent Technologies instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Agilent Technologies Company will, at its option, either repair or replace products which prove to be defective.

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Where to Find the Latest Information

Documentation is updated periodically. For the latest information about Agilent Spectrum Analyzers, including firmware upgrades and application information, please visit the following Internet URL:

<http://www.agilent.com/find/esa>

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**1 Agilent E4403B Specifications
and Characteristics**

About This Chapter

This chapter contains specifications and characteristics for the Agilent E4403B spectrum analyzer. The distinction between specifications and characteristics is described as follows.

- Specifications describe the performance of parameters covered by the product warranty. (The temperature range is 0 °C to 55 °C, unless otherwise noted.)
- Characteristics describe product performance that is useful in the application of the product, but is not covered by the product warranty.
- Typical performance describes additional product performance information that is not covered by the product warranty. It is performance beyond specification that 80% of the units exhibit with a 95% confidence level over the temperature range 20 to 30 °C. Typical performance does not include measurement uncertainty.
- Nominal values indicate the expected performance, or describe product performance that is useful in the application of the product, but is not covered by the product warranty.

The following conditions must be met for the analyzer to meet its specifications.

- o The analyzer is within the one year calibration cycle.
- o If **Auto Align All** is selected:
 - After 2 hours of storage within the operating temperature range.
 - 5 minutes after the analyzer is turned on with sweep times less than 4 seconds.
 - After the front-panel amplitude reference is connected to the INPUT, and **Align Now RF** has been run, after the analyzer is turned on. And, once every 24 hours, or if ambient temperature changes more than 30 °C.

- o If **Auto Align Off** is selected:
 - When the analyzer is at a constant temperature, within the operating temperature range, for a minimum of 90 minutes.
 - After the analyzer is turned on for a minimum of 90 minutes, the front panel amplitude reference has been connected to the INPUT, and **Align Now All** has been run.
 - When **Align Now All** is run:
 - Every hour
 - If the ambient temperature changes more than 3 °C
 - If the 10 MHz reference changes
 - When **Align Now RF** is run (with the front-panel amplitude reference connected to the INPUT):
 - Every 24 hours
 - If the ambient temperature changes more than 30 °C
- o If **Auto Align All but RF** is selected:
 - When the analyzer is at a constant temperature, within the operating temperature range, for a minimum of 90 minutes.
 - After the analyzer is turned on for a minimum of 90 minutes, the front panel amplitude reference has been connected to the INPUT, and **Align Now RF** has been run.
 - When **Align Now RF** is run (with the front-panel amplitude reference connected to the INPUT):
 - Every hour
 - If the ambient temperature changes more than 3 °C

Frequency

| | Specifications | Supplemental Information |
|------------------------|------------------|--------------------------|
| Frequency Range | 9 kHz to 3.0 GHz | |

| | Specifications | Supplemental Information |
|----------------------------|------------------------------|---|
| Frequency Reference | | |
| Aging Rate | $\pm 2 \times 10^{-6}$ /year | $\pm 1.0 \times 10^{-7}$ /day, characteristic |
| Settability | $\pm 5 \times 10^{-7}$ | |
| Temperature Stability | $\pm 5 \times 10^{-6}$ | |

| | Specifications | Supplemental Information |
|--|---|--------------------------|
| Frequency Readout Accuracy (Start, Stop, Center, Marker) | $\pm((\text{frequency indication} \times \text{frequency reference error}^a) + 0.75\% \text{ of span} + 15\% \text{ of RBW} + 10 \text{ Hz})$ | |

a. Frequency reference error = (aging rate \times period of time since adjustment + settability + temperature stability).

| | Specifications | Supplemental Information |
|---------------------------------|--|--------------------------|
| Marker Frequency Counter | | |
| Resolution | Selectable from 1 Hz to 100 kHz | |
| Accuracy ^a | $\pm(\text{marker frequency} \times \text{frequency reference error}^b + \text{counter resolution})$ | |

a. Marker level to displayed noise level > 25 dB, RBW/ Span ≥ 0.002 , frequency offset = 0 Hz.

b. Frequency reference error = (aging rate \times period of time since adjustment + settability + temperature stability).

| | Specifications | Supplemental Information |
|-----------------------|-----------------------------------|--------------------------|
| Frequency Span | | |
| Range | 0 Hz (zero span), 100 Hz to 3 GHz | |
| Resolution | 2 Hz | |
| Accuracy | ±1.0% of span | |

| | Specifications | Supplemental Information |
|------------------------------------|---|--|
| Sweep Time | | |
| Range | 4 ms to 4000 s ^a | |
| Tracking Generator On (Option 1DN) | | 50 ms is the minimum sweep time |
| Accuracy (Span = 0 Hz) | | |
| 4 ms to 4000 s ^a | ±1% | |
| Sweep Trigger ^b | Free Run, Single, Line, Video ^c , External, Delayed, Offset ^d | |
| Delayed Trigger ^e | | |
| Range | 1 μs to 400 s | |
| Resolution | $\frac{\text{delay in seconds}}{65000}$ rounded up to nearest μs | |
| Accuracy | ±(500 vσ + (0.01% of delay)) | |
| Offset Trigger ^d | | |
| Resolution | $\frac{\text{sweep time}}{400}$ | |
| Range | ±327 ms to ±323 ks | Where ST = sweep time $\frac{-32766 \times ST}{400}$ to $\frac{32365 \times ST}{400}$ |

- a. For firmware revisions prior to A.04.00, 5 ms to 2000 s.
- b. Auto align is suspended in video, external, and delayed trigger modes while waiting for a trigger event to occur.
- c. Unavailable when RBW ≤ 300 Hz (Option 1DR).
- d. For firmware revision A.04.00 or later.
- e. Delayed trigger is available with line and external trigger.

| | Specifications | Supplemental Information |
|-----------------------------|----------------|--------------------------|
| Sweep (trace) Points | 401 | |

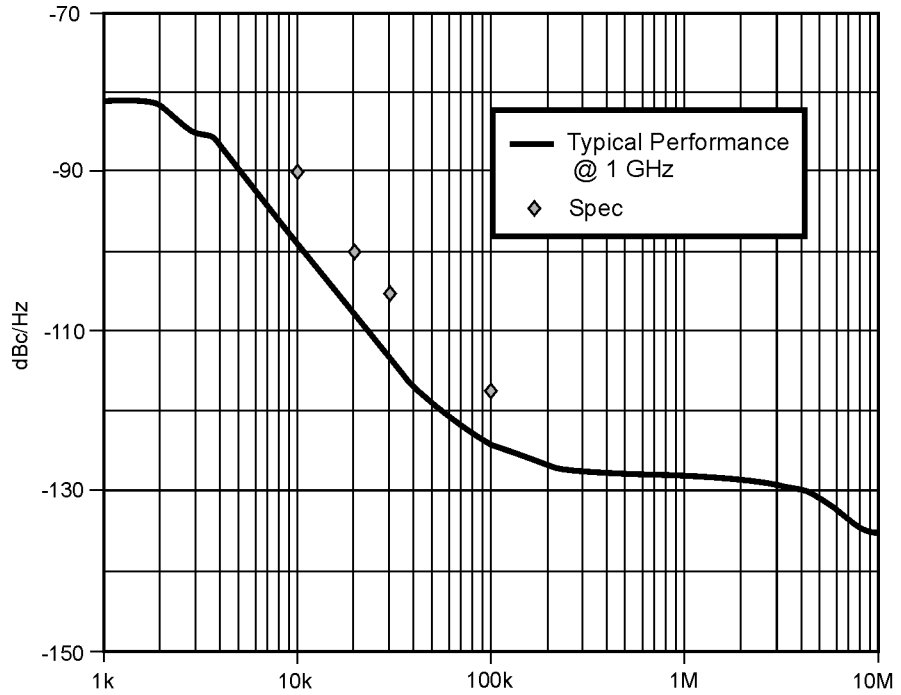
| | Specifications | Supplemental Information |
|--|---|--|
| Resolution Bandwidth (RBW) | | |
| Range | | |
| -3 dB bandwidth | 1 kHz to 3 MHz, in 1-3-10 sequence, 5 MHz | |
| <i>(Option 1DR)</i> | Adds 100, 300 Hz ^a | |
| -6 dB bandwidth (EMI) | 9 kHz and 120 kHz | |
| <i>(Option 1DR)</i> | Add 200 Hz ^a | |
| Accuracy | | |
| 100 Hz to 300 Hz (-3 dB) RBW | ±10% | |
| <i>(Option 1DR)</i> | | |
| 1 kHz to 3 MHz (-3 dB) RBW | ±15% | |
| 5 MHz (-3 dB) RBW | ±30% | |
| 9 kHz, 120 kHz (-6 dB) RBW (EMI) | ±20% | |
| 200 Hz (-6 dB) RBW (EMI) <i>(Option 1DR)</i> | ±10% | |
| Shape | | |
| 100 Hz to 300 Hz RBW <i>(Option 1DR)</i> | | Digital, approximately Gaussian shape |
| 1 kHz to 5 MHz RBW | | Synchronously tuned four poles, approximately Gaussian shape |
| Selectivity (60 dB/3 dB bandwidth ratio) | | |
| 100 Hz to 300 Hz RBW <i>(Option 1DR)</i> | | <5:1, nominal |
| 1 kHz to 5 MHz RBW | | <15:1, nominal |

a. Only available in spans ≤5 MHz, sweep times ≥ 4 ms, and not usable with tracking generator on (Option 1DN).

| | Specifications | Supplemental Information |
|--|--|--|
| Video Bandwidth (VBW) (-3 dB) Range <i>(Option 1DR)</i> Accuracy Shape | 30 Hz to 1 MHz in 1-3-10 sequence Adds 1, 3, 10 Hz for RBW's <1 kHz | 3 MHz, characteristic $\pm 30\%$, characteristic Post detection, single pole low-pass filter used to average displayed noise Video bandwidths below 30 Hz are digital bandwidths with anti-aliasing filtering. |

| | Specifications | Supplemental Information |
|--|--|--|
| Stability Noise Sidebands (Offset from CW signal with 1 kHz RBW, 30 Hz VBW and sample detector) ≥ 1 kHz (Option 1DR) ≥ 10 kHz ≥ 20 kHz ≥ 30 kHz ≥ 100 kHz Residual FM 1 kHz RBW, 1 kHz VBW 100 Hz RBW, 100 Hz VBW <i>(Option 1DR)</i> System-Related Sidebands, offset from CW signal ≥ 30 kHz | ≤ -90 dBc/Hz ≤ -100 dBc/Hz ≤ -106 dBc/Hz ≤ -118 dBc/Hz ≤ 150 Hz p-p in 100 ms ≤ -65 dBc | ≤ -78 dBc/Hz, typical ≤ -94 dBc/Hz, typical ≤ -105 dBc/Hz, typical ≤ -112 dBc/Hz, typical ≤ -122 dBc/Hz, typical ≤ 30 Hz p-p in 20 ms, characteristic |

Noise Sidebands Normalized to 1 Hz Versus Offset from Carrier



wl723b

Amplitude

Amplitude specifications do not apply for the negative peak detector mode.

| | Specifications | Supplemental Information |
|--------------------------|---|---|
| Measurement Range | Displayed Average Noise Level to Maximum Safe Input Level | |
| Input Attenuator Range | 0 to 65 dB, in 5 dB steps | 0 to 75 dB, in 5 dB steps, characteristic |

| | Specifications | Supplemental Information |
|--|-----------------|--------------------------|
| Maximum Safe Input Level | | |
| Average Continuous Power (Input attenuator setting ≥ 5 dB) | +30 dBm (1 W) | |
| Peak Pulse Power (for <10 μ sec pulse width, $<1\%$ duty cycle, and input attenuation ≥ 30 dB) | +50 dBm (100 W) | |
| dc | 100 Vdc | |

| | Specifications | Supplemental Information |
|---|----------------|--------------------------|
| 1 dB Gain Compression | | |
| Total power at input mixer ^{a, b} 50 MHz to 3.0 GHz | 0 dBm | |

a. Mixer power level (dBm) = input power (dBm) – input attenuation (dB).

b. For resolution bandwidths 1 kHz to 30 kHz, the maximum input signal amplitude must be \leq reference level +10 dB.

| | Specifications | | Supplemental Information | |
|--|------------------------|---|-------------------------------------|--|
| Displayed Average Noise Level (Input terminated, 0 dB attenuation, sample detector, Reference Level = -70 dBm) | | | | |
| | 1 kHz RBW 30 Hz VBW | 100 Hz RBW 1 Hz VBW <i>(Option 1DR)</i> | 1 kHz RBW 30 Hz VBW (typical) | 100 Hz RBW 1 Hz VBW <i>(Option 1DR)</i> (typical) |
| 1 MHz to 10 MHz | | | ≤ -117 dBm | ≤ -126 dBm |
| 10 MHz to 1.0 GHz | ≤ -117 dBm | ≤ -125 dBm | ≤ -120 dBm | ≤ -130 dBm |
| 1.0 GHz to 2.0 GHz | ≤ -116 dBm | ≤ -124 dBm | ≤ -120 dBm | ≤ -130 dBm |
| 2.0 GHz to 3.0 GHz | ≤ -114 dBm | ≤ -122 dBm | ≤ -120 dBm | ≤ -130 dBm |

| | Specifications | Supplemental Information |
|----------------------------------|---|--------------------------|
| Display Range | | |
| Log Scale | Ten divisions displayed; 0.1, 0.2, 0.5 dB/division and 1 to 20 dB/division in 1 dB steps | |
| RBW ≥ 1 kHz | Calibrated 0 to -85 dB from Reference Level | |
| RBW ≤ 300 Hz <i>(Option 1DR)</i> | Calibrated 0 to -120 dB ^a from Reference Level | |
| Linear Scale | Ten divisions | |
| Scale Units | dBm, dBmV, dBμV, dBμA, A, V, and W | |

a. 0 to -70 dB range when span = 0 Hz, or when IF Gain fixed:
(:DISPlay:WINDow:TRACe:Y[:SCALE]:LOG:RANGe:AUTO OFF).

| | Specifications | Supplemental Information |
|--|--|--------------------------|
| Marker Readout Resolution Log scale RBW \geq 1 kHz 0 to -85 dB from ref level RBW \leq 300 Hz (Option 1DR) 0 to -120 dB from ref level Linear scale | 0.04 dB 0.04 dB 0.01% of Reference Level | |

| | Specifications | Supplemental Information |
|---|--|--------------------------|
| Frequency Response^a 10 dB attenuation 9 kHz to 3.0 GHz 20 to 30 °C 0 to 55 °C | ± 0.5 dB ± 1.0 dB | |

a. Frequency response values are referenced to the amplitude at 50 MHz.

| | Specifications | Supplemental Information |
|---|---|--------------------------|
| Input Attenuation Switching Uncertainty at 50 MHz Attenuator Setting 0 dB to 5 dB 10 dB 15 dB 20 to 65 dB attenuation | ± 0.3 dB Reference ± 0.3 dB $\pm (0.1 \text{ dB} + 0.01 \times \text{Attenuator Setting})$ | |

| Attenuation Accuracy Relative to the 10 dB Attenuator Setting, Characteristic | | |
|--|------------------------|--|
| | Frequency Range | |
| Attenuation | dc-3.0 GHz | |
| 0 dB | ±0.3 dB | |
| 5 dB | ±0.3 dB | |
| 10 dB | Reference | |
| 15 dB | ±0.4 dB | |
| 20 dB | ±0.4 dB | |
| 25 dB | ±0.5 dB | |
| 30 dB | ±0.5 dB | |
| 35 dB | ±0.6 dB | |
| 40 dB | ±0.6 dB | |
| 45 dB | ±0.7 dB | |
| 50 dB | ±0.7 dB | |
| 55 dB | ±0.9 dB | |
| 60 dB | ±0.9 dB | |
| 65 dB | ±1.0 dB | |

| | Specifications | Supplemental Information |
|---|--|---------------------------------|
| Absolute Amplitude Accuracy | | |
| At reference settings ^a | ±0.4 dB | |
| Overall Amplitude Accuracy^b | | |
| 20 to 30 °C | ± (0.6 dB + Absolute Frequency Response) | |

- a. Settings are: reference level -20 dBm; input attenuation 10 dB; center frequency 50 MHz; RBW 1 kHz; VBW 1 kHz; amplitude scale linear or log; span 2 kHz; sweep time coupled, signal at reference level.
- b. For reference level 0 to -50 dBm; input attenuation 10 dB; RBW 1 kHz; VBW 1 kHz; amplitude scale log, log range 0 to -50 dB from reference level; sweep time coupled; signal input 0 to -50 dBm; span ≤20 kHz.

| | Specifications | Supplemental Information |
|--|----------------|--------------------------|
| RF Input VSWR (at tuned frequency) | | |
| Attenuator setting 0 dB 100 kHz to 3 GHz | | ≤3.0:1, characteristic |
| Attenuator setting 5 dB 100 kHz to 3 GHz | | ≤1.6:1, characteristic |
| Attenuator setting 10 to 65 dB 9 kHz to 100 kHz | | ≤2.0:1, characteristic |
| 100 kHz to 3 GHz | | ≤1.4:1, characteristic |

| | Specifications | Supplemental Information |
|-----------------------------------|----------------|--------------------------|
| Auto Alignment^a | | |
| Sweep-to-sweep variation | | ±0.1 dB, characteristic |

a. Set **Auto Align** to **Off** and use **Align Now, All** to eliminate this variation.

| | Specifications | Supplemental Information |
|--|----------------|--------------------------|
| Resolution Bandwidth Switching Uncertainty (at Reference Level) | | |
| 1 kHz RBW | Reference | |
| 3 kHz to 3 MHz RBW | ±0.3 dB | |
| 5 MHz RBW | ±0.6 dB | |
| 100 Hz to 300 Hz RBW (Option 1DR) | ±0.3 dB | |

| | Specifications | Supplemental Information |
|--|--|--------------------------|
| Reference Level | | |
| Range | -149.9 dBm to maximum mixer level + attenuator setting | |
| Resolution | | |
| Log Scale | ±0.1 dB | |
| Linear Scale | ±0.12% of Reference Level | |
| Accuracy (at a fixed frequency, a fixed attenuator, and referenced to -30 dBm) | | |
| Reference Level (dBm) – input attenuator setting (dB) | | |
| -10 dBm to > -60 dBm | ±0.3 dB | |
| -60 dBm to > -85 dBm | ±0.5 dB | |
| -85 dBm to -90 dBm | ±0.7 dB | |

| | Specifications | Supplemental Information |
|--|-----------------------------|--------------------------|
| Display Scale Switching Uncertainty | | |
| Switching between Linear and Log | ±0.15 dB at reference level | |
| Log Scale Switching | No error | |

| | Specifications | Supplemental Information |
|---|---|--------------------------------------|
| Display Scale Fidelity | | |
| Log Maximum Cumulative | | |
| RBW \geq 1 kHz | | |
| 0 to 85 dB Below Reference Level | $\pm(0.3 \text{ dB} + 0.01 \times \text{dB from reference level})$ | |
| RBW \leq 300 Hz (<i>Option 1DR</i>) | | |
| Span > 0 Hz | | |
| Auto range On | | |
| 0 to 98 dB ^a below reference level | $\pm(0.3 \text{ dB} + 0.01 \times \text{dB from reference level})$ | $\pm 2.0 \text{ dB, characteristic}$ |
| > 98 to 120 dB below reference level | | |
| Auto range Off ^b | | |
| 0 to 60 dB ^a below reference level | $\pm(0.3 \text{ dB} + 0.015 \times \text{dB from reference level})$ | |
| > 60 to 70 dB below reference level | $\pm 1.5 \text{ dB}$ | |
| Span = 0 Hz | | |
| 0 to 60 dB ^a below reference level | $\pm(0.3 \text{ dB} + 0.015 \times \text{dB from reference level})$ | |
| > 60 to 70 dB below reference level | $\pm 1.5 \text{ dB}$ | |
| Log Incremental Accuracy | | |
| 0 to 80 dB ^{a,c} below reference level | $\pm 0.4 \text{ dB/4 dB}$ | |
| Linear Accuracy | $\pm 2\%$ of Reference Level | |

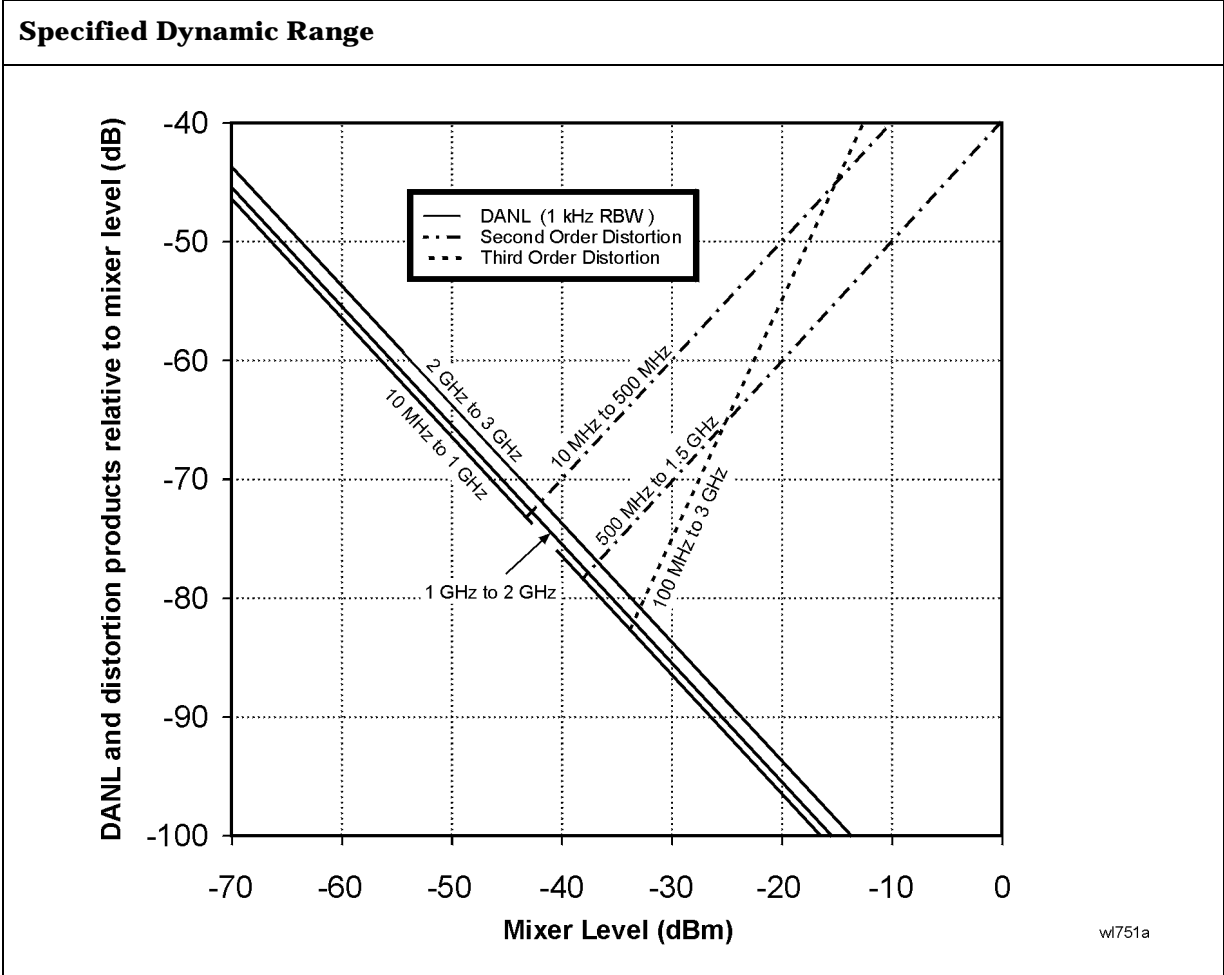
a. 0 to 30 dB for RBW = 200 Hz

b. The SCPI command for auto range off is:
(:DISPlay:WINDow:TRACe:Y[:SCALe]:LOG:RANGe:AUTO OFF)

c. 0 to 50 dB for RBWs \leq 300 Hz and span = 0 Hz, or when auto ranging is off.

| | Specifications | Supplemental Information |
|--|--|--|
| Spurious Responses | | |
| Second Harmonic Distortion | | |
| Input Signal | | |
| 10 MHz to 500 MHz | < -60 dBc for -30 dBm signal at input mixer ^a | +30 dBm SHI (second harmonic intercept) |
| 500 MHz to 1.5 GHz | < -70 dBc for -30 dBm signal at input mixer ^a | +40 dBm SHI |
| Third Order Intermodulation Distortion | | |
| 10 MHz to 100 MHz | | +5 dBm TOI (third order intercept), characteristic |
| 100 MHz to 3 GHz | < -75 dBc for two -30 dBm signals at input mixer ^a and >50 kHz separation | +7.5 dBm TOI |
| Other Input Related Spurious | | |
| >30 kHz offset | < -65 dBc for -20 dBm signal at input mixer ^a | |

a. Mixer power level (dBm) = input power (dBm) - input attenuation (dB)



| | Specifications | Supplemental Information |
|---|----------------|--------------------------|
| Residual Responses (Input terminated and 0 dB attenuation) 150 kHz to 3 GHz | < -90 dBm | |

Options

Tracking Generator (Option 1DN)

The spectrum analyzer/tracking generator combination will meet its specification after a cable (8120-5148) and adapter are connected between RF OUT and INPUT and **Align Now, TG** has been run.

| | Specifications | Supplemental Information |
|----------------|----------------|--------------------------|
| Warm-up | 5 minutes | |

| | Specifications | Supplemental Information |
|-------------------------------|------------------|--------------------------|
| Output Frequency Range | 9 kHz to 3.0 GHz | |

| | Specifications | Supplemental Information |
|-----------------------|----------------|--|
| Minimum Resolution BW | 1 kHz | Not usable with resolution bandwidths ≤ 300 Hz (<i>Option 1DR</i>) |

| | Specifications | Supplemental Information |
|---|--------------------------|--------------------------|
| Output Power Level | | |
| Range | -2 to -66 dBm | |
| Resolution | 0.1 dB | |
| Absolute Accuracy (at 50 MHz with coupled source attenuator, referenced to -20 dBm) | ± 0.75 dB | |
| Vernier | | |
| Range | 8 dB | |
| Accuracy (with coupled source attenuator, 50 MHz, -20 dBm) | | |
| Incremental | ± 0.2 dB/dB | |
| Cumulative | ± 0.5 dB, total | |
| Output Attenuator Range | 0 to 56 dB in 8 dB steps | |

| | Specifications | Supplemental Information |
|-----------------------------------|----------------|---------------------------------------|
| Maximum Safe Reverse Level | | +30 dBm (1 W), 50 Vdc, characteristic |

| | Specifications | Supplemental Information |
|---------------------------|---|--------------------------|
| Output Power Sweep | | |
| Range | (-10 to -2 dBm) – (Source Attenuator Setting) | |
| Resolution | 0.1 dB | |
| Accuracy (zero span) | <1 dB peak-to-peak | |

| | Specifications | Supplemental Information |
|-------------------------------|----------------|--------------------------|
| Output Flatness | | |
| Referenced to 50 MHz, -20 dBm | | |
| 9 kHz to 10 MHz | ±3 dB | |
| 10 MHz to 3 GHz | ±2 dB | |

| | Specifications | Supplemental Information |
|---|----------------|--------------------------|
| Spurious Outputs | | |
| (-2 dBm output) | | |
| Harmonic Spurs | | |
| TG Output 9 kHz to 20 kHz | ≤ -15 dBc | |
| TG Output 20 kHz to 3 GHz | ≤ -25 dBc | |
| Non-harmonic Spurs | | |
| TG Output 9 kHz to 2 GHz | ≤ -27 dBc | |
| TG Output 2 GHz to 3 GHz | ≤ -23 dBc | |
| LO Feedthrough | | |
| LO Frequency 3.921409 GHz to 6.9214 GHz | ≤ -16 dBm | |

| | Specifications | Supplemental Information |
|----------------------|---|---------------------------------|
| Dynamic Range | Maximum Output Power Level – Displayed Average Noise Level | |

| | Specifications | Supplemental Information |
|------------------------|-----------------------|--|
| Output Tracking | | |
| Drift | | 1.5 kHz/5 minute, characteristic |
| Swept Tracking Error | | Usable in 1 kHz RBW after 5 minutes of warm-up |

| | Specifications | Supplemental Information |
|-------------------------------|-----------------------|---------------------------------|
| RF Power-Off Residuals | | |
| 9 kHz to 3 GHz | | < –120 dBm, characteristic |

| | Specifications | Supplemental Information |
|--|-----------------------|---------------------------------|
| Output Attenuator Repeatability | | |
| 9 kHz to 300 MHz | | ±0.1 dB, characteristic |
| 300 MHz to 2 GHz | | ±0.2 dB, characteristic |
| 2 GHz to 3 GHz | | ±0.3 dB, characteristic |

| | Specifications | Supplemental Information |
|--------------------|-----------------------|---------------------------------|
| Output VSWR | | |
| 0 dB attenuation | | <2.0:1, characteristic |
| ≥ 8 dB attenuation | | <1.5:1, characteristic |

| | Specifications | Supplemental Information |
|-----------------------------------|----------------|--------------------------|
| Output Attenuator Accuracy | | |
| 0 dB | Reference | ±0.5 dB, characteristic |
| 8 dB | | ±0.5 dB, characteristic |
| 16 dB | | |
| 24 dB | | ±0.5 dB, characteristic |
| 32 dB | | ±0.6 dB, characteristic |
| 40 dB | | ±0.8 dB, characteristic |
| 48 dB | | ±1.0 dB, characteristic |
| 56 dB | | ±1.1 dB, characteristic |

| |
|--|
| Tracking Generator Output Accuracy |
| Relative Accuracy (Referred to -20 dBm) = Output Attenuator Accuracy + Vernier Accuracy + Output Flatness |
| Absolute Accuracy = Relative Accuracy (Referred to -20 dBm) + Absolute Accuracy at 50 MHz |

Agilent E4403B Specifications and Characteristics

General

| | Specifications | Supplemental Information |
|--------------------------|----------------|--------------------------|
| Temperature Range | | |
| Operating | 0 to 55 °C | Floppy disk 10 to 40 °C |
| Storage | <40 to 75 °C | |

| | Specifications | Supplemental Information |
|---------------------------------|----------------|----------------------------|
| Audible Noise (ISO 7779) | | |
| Sound Pressure at 25 °C | | <40 dBa, (<4.6 Bels power) |

| | Specifications | Supplemental Information |
|-------------------------------|---|--------------------------|
| Military Specification | Has been type tested to the environmental specifications of MIL-PRF-28800F class 3. | |

| | Specifications | Supplemental Information |
|--------------------------|---|--------------------------|
| EMI Compatibility | Conducted and radiated emission is in compliance with CISPR Pub. 11/1990 Group 1 Class A. | |

| | Specifications | Supplemental Information |
|-------------------------|----------------|---|
| Immunity Testing | | |
| Radiated Immunity | | Testing was done at 3 V/m according to IEC 801-3/1984. When the analyzer tuned frequency is identical to the immunity test signal frequency, there may be signals of up to -60 dBm displayed on the screen. |
| Electrostatic Discharge | | Air discharges of up to 8 kV were applied according to IEC 801-2/1991. Discharges to center pins of any of the connectors may cause damage to the associated circuitry. |

| | Specifications | Supplemental Information |
|----------------------------|--|--------------------------|
| Power Requirements | | |
| ac Operation | | |
| Voltage, frequency | 90 to 132 Vrms, 47 to 440 Hz 195 to 250 Vrms, 47 to 66 Hz | |
| Power Consumption, On | <300 W | |
| Power Consumption, Standby | <5 W | |
| dc Operation | | |
| Voltage | 12 to 20 Vdc | |
| Power Consumption | <200 W | |
| Power Consumption, Standby | <100 mW | |

| | Specifications | Supplemental Information |
|--|----------------|--------------------------|
| Measurement Speed | | |
| Local Measurement and Display Update rate ^a | | ≥ 30/s, characteristic |
| Remote Measurement and GPIB Transfer Rate ^{b, c} (Option A4H) | | ≥30/s, characteristic |
| RF Center Frequency Tune, Measure, and GPIB Transfer Time ^{b, d} (Option A4H) | | ≤ 90 ms, characteristic |

- a. Factory preset, auto align Off, fixed center frequency, RBW = 1 MHz, and spans >10 MHz and ≤600 MHz.
- b. Display Off (:DISPlay:ENABLE OFF), and 32-bit integer data format (:FORMat:DATA INT,32), if Option A4J is installed, disable sweep ramp, (:SYS-Tem:PORTs:IFVSweep:ENABLE OFF), markers Off, single sweep, measured with IBM compatible PC with 550 MHz Pentium® III running Windows® NT 4.0, one meter GPIB cable, National Instruments PCI-GPIB card and NI-488.2 DLL.
- c. Factory preset, auto align Off, RBW = 1 MHz, span= 20 MHz, fixed center frequency, average of 100 measurements.
- d. Factory preset, auto align Off, RBW = 1 MHz, span= 20 MHz, and center frequency tune step size = 50 MHz.

| | Specifications | Supplemental Information |
|---------------------------|----------------|--|
| Data Storage | | |
| Internal ^a | | 8.0 MB, nominal |
| External (10 to 40 °C) | | 3.5" 1.44 MB, MS-DOS® compatible floppy disk |

a. For serial numbers prior to US41440000 or MY41440000, 1 MB without Option B72, 8 MB with Option B72.

| | Specifications | Supplemental Information |
|------------------------------------|----------------|------------------------------|
| Memory Usage | | |
| State | | 20 kB ^a , nominal |
| State plus 401-point trace | | 21 kB ^a , nominal |
| Applications memory usage | | |
| 8590 Compatibility (Option 290) | | 0.7 MB, nominal |

a. The size of state will increase depending on installed applications.

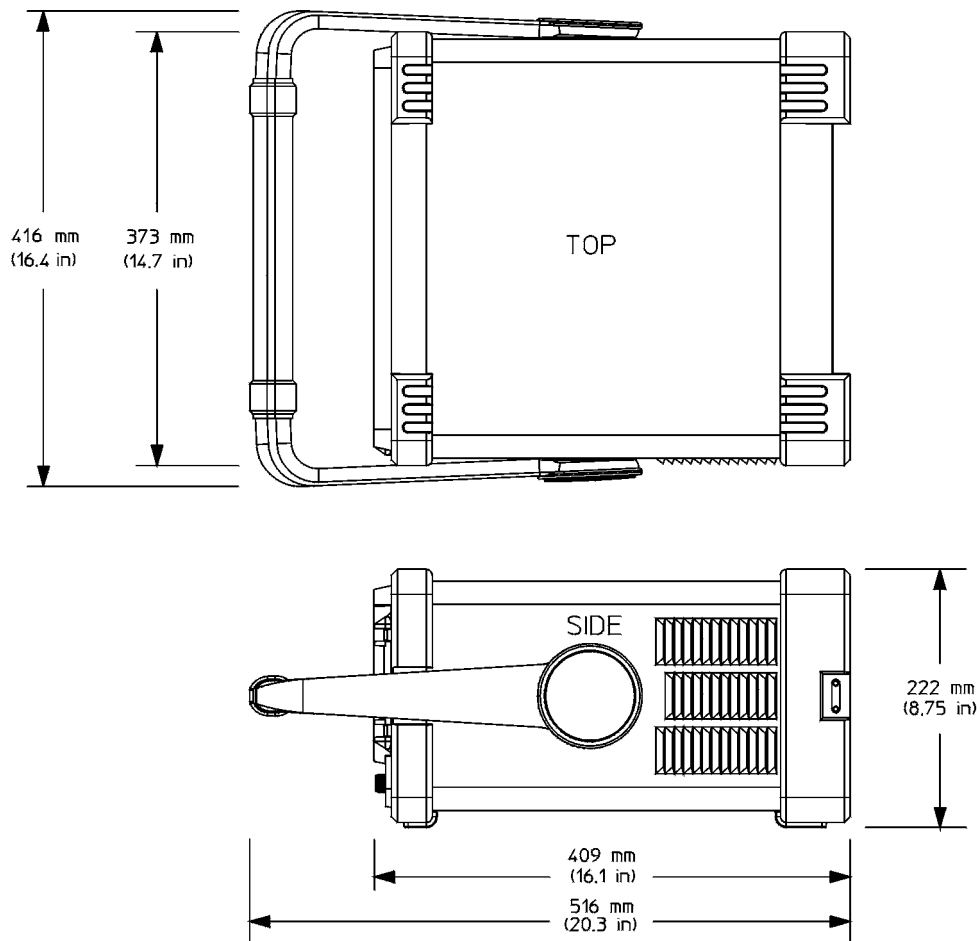
| | Specifications | Supplemental Information |
|------------------------------|----------------|--|
| Demod Tune and Listen | | |
| Demod (Option A4J) | AM | Internal speaker, front-panel earphone jack and front-panel volume control. An uncalibrated demodulated signal is available on the AUX VIDEO OUT connector at the rear panel. |

| | Specifications | Supplemental Information |
|---------------------------------|----------------|-----------------------------------|
| Weight (without options) | | |
| Net | | 15.5 kg (34.2 lb), characteristic |
| Shipping | | 27.4 kg (60.4 lb), characteristic |

| | Specifications | Supplemental Information |
|----------------------------|----------------|--------------------------|
| Display^a | | |
| Resolution | 640 × 480 | |

- a. The LCD display is manufactured using high precision technology. However, there may be up to six bright points (white, blue, red or green in color) that constantly appear on the LCD screen. These points are normal in the manufacturing process and do not affect the measurement integrity of the product in any way.

Dimensions



nl742a

Inputs and Outputs

Front Panel

| | Specifications | Supplemental Information |
|-------------------|----------------|---|
| INPUT 50 Ω | | |
| Connector | Type-N female | |
| Impedance | | 50 Ω, nominal |
| LO Emissions | | < -70 dBm, characteristic. Average level of 1st LO, 3.9214 to 6.9214 GHz, present at INPUT 50 Ω connector. |

| | Specifications | Supplemental Information |
|----------------------------------|----------------|--------------------------|
| RF OUT 50 Ω, (Option 1DN) | | |
| Connector | Type-N female | |
| Impedance | | 50 Ω, nominal |

| | Specifications | Supplemental Information |
|----------------------------------|----------------|--|
| AMPTD REF OUT^a | | Amplitude Reference |
| Connector | BNC female | |
| Impedance | | 50 Ω, nominal |
| Frequency | | 50 MHz |
| Frequency Accuracy | | Frequency reference error ^b |
| 50 Ω Amplitude ^c | | -20 dBm, nominal |

- a. Turn the amplitude reference on/off by pressing the keys: **Input/Output, Amptd Ref Out**.
- b. Frequency reference error = (aging rate × period of time since adjustment + settability + temperature stability).
- c. The internal amplitude reference actual power is stored internally.

| | Specifications | Supplemental Information |
|---------------------------------------|----------------|--|
| PROBE POWER Voltage/Current | | +15 Vdc, $\pm 7\%$ at 150 mA max., characteristic -12.6 Vdc $\pm 10\%$ at 150 mA max., characteristic |

| | Specifications | Supplemental Information |
|--|------------------------|---|
| EXT KEYBOARD^a Connector | 6-pin mini-DIN | Used for entering screen titles and filenames only. Interface compatible with most IBM-compatible PC keyboards. |

a. The feature is not implemented in firmware revisions prior to A.04.00.

| | Specifications | Supplemental Information |
|----------------|----------------|----------------------------------|
| Speaker | | Front panel knob controls volume |

| | Specifications | Supplemental Information |
|---|--|--|
| Headphone Connector Power Output | 3.5 mm (1/8 inch) miniature audio jack | Front panel knob controls volume 0.2 W into 4 Ω , characteristic |

Rear Panel

| | Specifications | Supplemental Information |
|---|----------------|---|
| 10 MHz REF OUT Connector Impedance Output Amplitude | BNC female | 50 Ω , nominal >0 dBm, characteristic |

| | Specifications | Supplemental Information |
|-----------------------|----------------|---|
| 10 MHz REF IN | | |
| Connector | BNC female | Note: Analyzer noise sidebands and spurious response performance may be affected by the quality of the external reference used. |
| Impedance | | 50 Ω , nominal |
| Input Amplitude Range | | -15 to +10 dBm, characteristic |
| Frequency | | 10 MHz, nominal |

| | Specifications | Supplemental Information |
|------------------------------|----------------|---|
| GATE TRIG/EXT TRIG IN | | |
| Connector | BNC female | |
| External Trigger Input | | |
| Trigger Level | | Selectable positive or negative edge initiates sweep in EXT TRIG mode (5 V TTL) |

| | Specifications | Supplemental Information |
|------------------------|----------------|---|
| GATE/HI SWP OUT | | |
| Connector | BNC female | |
| High Sweep Output | | |
| Level | | High = sweep ^a ; Low = retrace (5 V TTL) |

a. High sweep may be high longer than the indicated sweep times.

| | Specifications | Supplemental Information |
|-------------------|-----------------------------------|---|
| VGA OUTPUT | | |
| Connector | VGA compatible, 15-pin mini D-SUB | |
| Format | | VGA (31.5 kHz horizontal, 60 Hz vertical sync rates, non-interlaced) Analog RGB |
| Resolution | 640 \times 480 | |

| | Specifications | Supplemental Information |
|---|----------------|--|
| AUX IF OUT <i>(Option A4J)</i> Connector Frequency Amplitude (for signal at reference level and for reference levels – input attenuation of –10 to –70 dBm) Impedance | BNC female | $PB\Omega \geq 1 \text{ kHz}$ 21.4 MHz, nominal –10 dBm (uncorrected), characteristic 50 Ω , nominal |

| | Specifications | Supplemental Information |
|--|----------------|---|
| AUX VIDEO OUT <i>(Option A4J)</i> Connector Amplitude Range (into >10 k Ω) | BNC female | $PB\Omega \geq 1 \text{ kHz}$ 0 to 1 V (uncorrected), characteristic |

| | Specifications | Supplemental Information |
|---|----------------|--|
| HI SWP IN <i>(Option A4J)</i> Connector Input | BNC female | Open collector, low resets and holds the sweep (5 V TTL) |

| | Specifications | Supplemental Information |
|---|----------------|---|
| HI SWP OUT <i>(Option A4J)</i> Connector Output | BNC female | High = sweep ^a , Low = retrace (5 V TTL) |

a. High sweep may be high longer than the indicated sweep times.

| | Specifications | Supplemental Information |
|---------------------------------------|----------------|---------------------------------|
| SWP OUT <i>(Option A4J)</i> | | |
| Connector | BNC female | |
| Amplitude | | 0 to +10 V ramp, characteristic |

| | Specifications | Supplemental Information |
|--|------------------------|--|
| GPIB Interface <i>(Option A4H)</i> | | |
| Connector | IEEE-488 bus connector | |
| GPIB Codes | | SH1, AH1, T6, SR1, RL1, PP0, DC1, C1, C2, C3 and C28 |

| | Specifications | Supplemental Information |
|--|------------------|--------------------------|
| Serial Interface <i>(Option 1AX)</i> | | |
| Connector | 9-pin D-SUB male | RS-232 |

| | Specifications | Supplemental Information |
|---|---------------------|--------------------------|
| Parallel Interface <i>(Option A4H or 1AX)</i> | | Printer port only |
| Connector | 25-pin D-SUB female | |

Regulatory Information

CAUTION This product is designed for use in Installation Category II and Pollution Degree 2 per IEC 1010 and 664 respectively.

NOTE This product has been designed and tested in accordance with IEC Publication 1010, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the product in a safe condition.



The CE mark is a registered trademark of the European Community (if accompanied by a year, it is the year when the design was proven).



The CSA mark is the Canadian Standards Association safety mark.

ISM 1-A

This is a symbol of an Industrial Scientific and Medical Group 1 Class A product. (CISPR 11, Clause 4)

Declaration of Conformity

DECLARATION OF CONFORMITY

According to ISO/IEC Guide 22 and CEN/CENELEC EN 45014

Manufacturer's Name: Agilent Technologies, Inc.

Manufacturer's Address: 1400 Fountaingrove Parkway
Santa Rosa, CA 95403-1799
USA

Declares that the products

Product Name: Spectrum Analyzer

Model Number: E4401B, E4402B, E4403B, E4404B,
E4405B, E4407B, E4408B, E4411B

Product Options: This declaration covers all options of the above products.

Conform to the following product specifications:


EMC: IEC 61326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998

| <u>Standard</u> | <u>Limit</u> |
|--|-------------------------|
| CISPR 11:1990 / EN 55011-1991 | Group 1, Class A |
| IEC 61000-4-2:1995+A1998 / EN 61000-4-2:1995 | 4 kV CD, 8 kV AD |
| IEC 61000-4-3:1995 / EN 61000-4-3:1995 | 3 V/m, 80 - 1000 MHz |
| IEC 61000-4-4:1995 / EN 61000-4-4:1995 | 0.5 kV sig., 1 kV power |
| IEC 61000-4-5:1995 / EN 61000-4-5:1996 | 0.5 kV L-L, 1 kV L-G |
| IEC 61000-4-6:1996 / EN 61000-4-6:1998 | 3 V, 0.15 - 80 MHz |
| IEC 61000-4-11:1994 / EN 61000-4-11:1998 | 1 cycle, 100% |

Safety: IEC 61010-1:1990 + A1:1992 + A2:1995 / EN 61010-1:1993 +A2:1995
CAN/CSA-C22.2 No. 1010.1-92

Supplementary Information:

The products herewith comply with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC and carry the CE-marking accordingly.



Santa Rosa, CA, USA 17 April 2000

Greg Pfeiffer/Quality Engineering Manager

For further information, please contact your local Agilent Technologies sales office, agent or distributor.

2 Agilent E4408B Specifications and Characteristics

About This Chapter

This chapter contains specifications and characteristics for the Agilent E4408B spectrum analyzer. The distinction between specifications and characteristics is described as follows.

- Specifications describe the performance of parameters covered by the product warranty. (The temperature range is 0 °C to 55 °C, unless otherwise noted.)
- Characteristics describe product performance that is useful in the application of the product, but is not covered by the product warranty.
- Typical performance describes additional product performance information that is not covered by the product warranty. It is performance beyond specification that 80% of the units exhibit with a 95% confidence level over the temperature range 20 to 30 °C. Typical performance does not include measurement uncertainty.
- Nominal values indicate the expected performance, or describe product performance that is useful in the application of the product, but is not covered by the product warranty.

The following conditions must be met for the analyzer to meet its specifications.

- o The analyzer is within the one year calibration cycle.
- o If **Auto Align All** is selected:
 - After 2 hours of storage within the operating temperature range.
 - 5 minutes after the analyzer is turned on with sweep times less than 4 seconds.
 - After the front-panel amplitude reference is connected to the INPUT, and **Align Now RF** has been run, after the analyzer is turned on. And, once every 24 hours, or if ambient temperature changes more than 30 °C.

- o If **Auto Align Off** is selected:
 - When the analyzer is at a constant temperature, within the operating temperature range, for a minimum of 90 minutes.
 - After the analyzer is turned on for a minimum of 90 minutes, the front panel amplitude reference has been connected to the INPUT, and **Align Now All** has been run.
 - When **Align Now All** is run:
 - Every hour
 - If the ambient temperature changes more than 3 °C
 - If the 10 MHz reference changes
 - When **Align Now RF** is run (with the front-panel amplitude reference connected to the INPUT):
 - Every 24 hours
 - If the ambient temperature changes more than 30 °C
- o If **Auto Align All but RF** is selected:
 - When the analyzer is at a constant temperature, within the operating temperature range, for a minimum of 90 minutes.
 - After the analyzer is turned on for a minimum of 90 minutes, the front panel amplitude reference has been connected to the INPUT, and **Align Now RF** has been run.
 - When **Align Now RF** is run (with the front-panel amplitude reference connected to the INPUT):
 - Every hour
 - If the ambient temperature changes more than 3 °C

Frequency

| | Specifications | Supplemental Information | |
|--------------------------|-------------------|--|----|
| Frequency Range | 9 kHz to 26.5 GHz | Harmonic Mixing Mode (N ^a) | |
| Band | | | |
| 0 (0 Hz to 3.0 GHz) | | | 1– |
| 1 (2.85 GHz to 6.7 GHz) | | | 1– |
| 2 (6.2 GHz to 13.2 GHz) | | | 2– |
| 3 (12.8 GHz to 19.2 GHz) | | | 4– |
| 4 (18.7 GHz to 26.5 GHz) | 4– | | |

- a. N is the harmonic mixing mode. For negative mixing modes (as indicated by the “–”), the desired 1st LO harmonic is higher than the tuned frequency by the 1st IF (3.9214 for the 9 kHz to 3 GHz band, 321.4 MHz for all other bands).

| | Specifications | Supplemental Information |
|----------------------------|------------------------------------|--|
| Frequency Reference | | |
| Aging Rate | $\pm 2 \times 10^{-6}/\text{year}$ | $\pm 1.0 \times 10^{-7}/\text{day}$, characteristic |
| Settability | $\pm 5 \times 10^{-7}$ | |
| Temperature Stability | $\pm 5 \times 10^{-6}$ | |

| | Specifications | Supplemental Information |
|-----------------------------------|--|--------------------------|
| Frequency Readout Accuracy | $\pm((\text{frequency indication} \times \text{frequency reference error}^{\text{a}})$ $+ 0.75\% \text{ of span}$ $+ 15\% \text{ of RBW}$ $+ 10 \text{ Hz} + 1 \text{ Hz} \times N^{\text{b}})$ | |
| (Start, Stop, Center, Marker) | | |

- a. Frequency reference error = (aging rate \times period of time since adjustment + settability + temperature stability).
 b. N is the harmonic mixing mode.

| | Specifications | Supplemental Information |
|---------------------------------|--|--------------------------|
| Marker Frequency Counter | | |
| Resolution | Selectable from 1 Hz to 100 kHz | |
| Accuracy ^a | $\pm(\text{marker frequency} \times \text{frequency reference error}^b + \text{counter resolution})^c$ | |

- a. Marker level to displayed noise level > 25 dB, RBW/ Span \geq 0.002, frequency offset = 0 Hz.
- b. Frequency reference error = (aging rate \times period of time since adjustment + settability + temperature stability).
- c. For firmware revisions prior to A.03.00, add 1 Hz \times N, where N is the harmonic mixing mode.

| | Specifications | Supplemental Information |
|-----------------------|--------------------------------------|--------------------------|
| Frequency Span | | |
| Range | 0 Hz (zero span), 100 Hz to 26.5 GHz | |
| Resolution | 2 Hz \times N ^a | |
| Accuracy | $\pm 1.0\%$ of span | |

- a. N is the harmonic mixing mode.

| | Specifications | Supplemental Information |
|---------------------------------------|--|--|
| Sweep Time | | |
| Range | 4 ms to 4000 s ^a | 50 ms is the minimum sweep time |
| Tracking Generator On (Option 1DN) | | |
| Accuracy (Span = 0 Hz) | | |
| 4 ms to 4000 s ^a | ±1% | |
| Sweep Trigger ^b | Free Run, Single, Line, Video ^c , External, Delayed, Offset ^d | |
| Delayed Trigger ^e | | |
| Range | 1 μs to 400 s | |
| Resolution | $\frac{\text{delay in seconds}}{65000}$ rounded up to nearest μs | |
| Accuracy | ±(500 ns + (0.01% of delay)) | |
| Offset Trigger ^d | | |
| Resolution | $\frac{\text{sweep time}}{400}$ | |
| Range | ±327 ms to ±323 ks | Where ST = sweep time $\frac{-32766 \times ST}{400}$ to $\frac{32365 \times ST}{400}$ |

- a. For firmware revisions prior to A.04.00, 5 ms to 2000 s.
- b. Auto align is suspended in video, external, and delayed trigger modes while waiting for a trigger event to occur.
- c. Unavailable when RBW ≤ 300 Hz (Option 1DR).
- d. For firmware revision A.04.00 or later.
- e. Delayed trigger is available with line and external trigger.

| | Specifications | Supplemental Information |
|-----------------------------|----------------|--------------------------|
| Sweep (trace) Points | 401 | |

| | Specifications | Supplemental Information |
|--|---|--|
| Resolution Bandwidth (RBW) | | |
| Range | | |
| -3 dB bandwidth | 1 kHz to 3 MHz, in 1-3-10 sequence, 5 MHz | |
| <i>(Option 1DR)</i> | Adds 100, 300 Hz ^a | |
| -6 dB bandwidth (EMI) | 9 kHz and 120 kHz | |
| <i>(Option 1DR)</i> | Add 200 Hz ^a | |
| Accuracy | | |
| 100 Hz to 300 Hz (-3 dB) RBW | ±10% | |
| <i>(Option 1DR)</i> | | |
| 1 kHz to 3 MHz (-3 dB) RBW | ±15% | |
| 5 MHz (-3 dB) RBW | ±30% | |
| 9 kHz, 120 kHz (-6 dB) RBW (EMI) | ±20% | |
| 200 Hz (-6 dB) RBW (EMI) <i>(Option 1DR)</i> | ±10% | |
| Shape | | |
| 100 Hz to 300 Hz RBW <i>(Option 1DR)</i> | | Digital, approximately Gaussian shape |
| 1 kHz to 5 MHz RBW | | Synchronously tuned four poles, approximately Gaussian shape |
| Selectivity (60 dB/3 dB bandwidth ratio) | | |
| 100 Hz to 300 Hz RBW <i>(Option 1DR)</i> | | <5:1, nominal |
| 1 kHz to 5 MHz RBW | | <15:1, nominal |

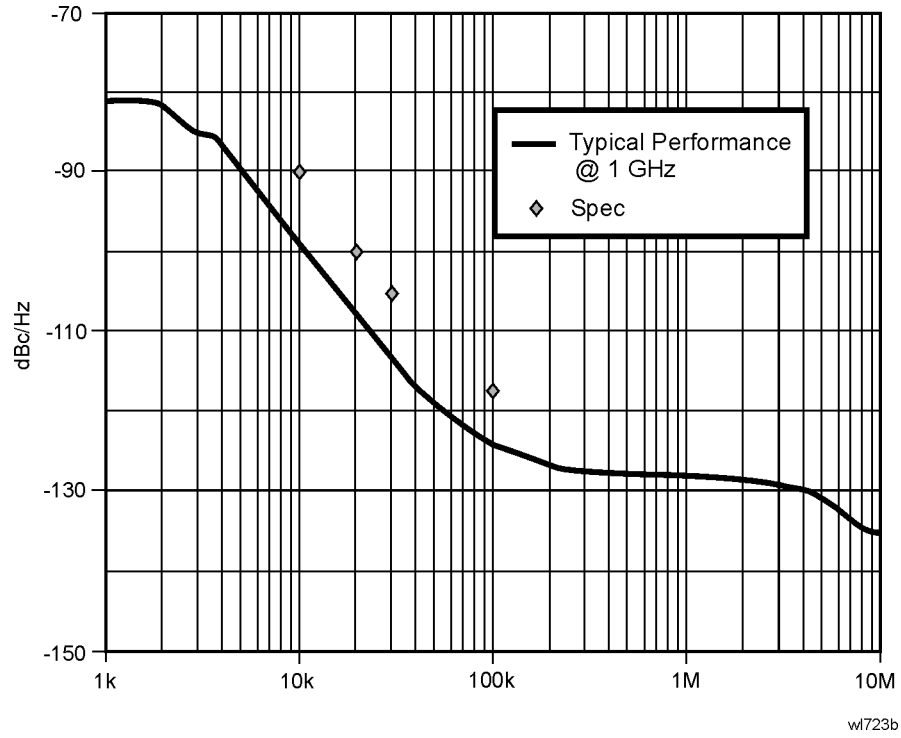
a. Only available in spans ≤5 MHz, sweep times ≥ 4 ms, and not usable with tracking generator on *(Option 1DN)*.

| | Specifications | Supplemental Information |
|--|------------------------------------|--|
| Video Bandwidth (VBW) (-3 dB) | | |
| Range | 30 Hz to 1 MHz in 1-3-10 sequence | 3 MHz, characteristic |
| <i>(Option 1DR)</i> | Adds 1, 3, 10 Hz for RBW's < 1 kHz | |
| Accuracy | | ±30%, characteristic |
| Shape | | Post detection, single pole low-pass filter used to average displayed noise Video bandwidths below 30 Hz are digital bandwidths with anti-aliasing filtering. |

| | Specifications | Supplemental Information |
|--|----------------------------|---|
| Stability | | |
| Noise Sidebands (Offset from CW signal with 1 kHz RBW, 30 Hz VBW and sample detector) | | |
| ≥1 kHz <i>(Option 1DR)</i> | | ≤ -78 dBc/Hz ^a , typical |
| ≥10 kHz | ≤ -90 dBc/Hz ^a | ≤ -94 dBc/Hz ^a , typical |
| ≥20 kHz | ≤ -100 dBc/Hz ^a | ≤ -105 dBc/Hz ^a , typical |
| ≥30 kHz | ≤ -106 dBc/Hz ^a | ≤ -112 dBc/Hz ^a , typical |
| ≥100 kHz | ≤ -118 dBc/Hz ^a | ≤ -122 dBc/Hz ^a , typical |
| Residual FM | | |
| 1 kHz RBW, 1 kHz VBW | ≤150 Hz × N p-p in 100 ms | |
| 100 Hz RBW, 100 Hz VBW <i>(Option 1DR)</i> | | ≤30 Hz × N p-p in 20 ms, characteristic |
| System-Related Sidebands, offset from CW signal | | |
| ≥30 kHz | ≤ -65 dBc ^a | |

a. Add 20 Log(N) for frequencies > 6.7 GHz.

Noise Sidebands Normalized to 1 Hz Versus Offset from Carrier



Amplitude

Amplitude specifications do not apply for the negative peak detector mode.

| | Specifications | Supplemental Information |
|--------------------------|---|--------------------------|
| Measurement Range | Displayed Average Noise Level to Maximum Safe Input Level | |
| Input Attenuator Range | 0 to 65 dB, in 5 dB steps | |

| | Specifications | Supplemental Information |
|--|-----------------|--------------------------|
| Maximum Safe Input Level | | |
| Average Continuous Power (Input attenuator setting ≥ 5 dB) | +30 dBm (1 W) | |
| Peak Pulse Power (for <10 μ sec pulse width, $<1\%$ duty cycle, and input attenuation ≥ 30 dB) | +50 dBm (100 W) | |
| dc | 0 Vdc | |

| | Specifications | Supplemental Information |
|---|----------------|--------------------------|
| 1 dB Gain Compression | | |
| Total power at input mixer ^{a,b} | | |
| 50 MHz to 3.0 GHz | 0 dBm | |
| 3.0 GHz to 6.7 GHz | 0 dBm | |
| 6.7 GHz to 13.2 GHz | -3 dBm | |
| 13.2 GHz to 26.5 GHz | -5 dBm | |

a. Mixer power level (dBm) = input power (dBm) – input attenuation (dB).

b. For resolution bandwidths 1 kHz to 30 kHz, the maximum input signal amplitude must be \leq reference level +10 dB.

| | Specifications | | Supplemental Information | |
|--|-------------------------|--|-------------------------------------|---|
| Displayed Average Noise Level (Input terminated, 0 dB attenuation, sample detector, Reference Level = -70 dBm) | | | | |
| | 1 kHz RBW, 30 Hz VBW | 100 Hz RBW 1 Hz VBW (Option 1DR) | 1 kHz RBW 30 Hz VBW (typical) | 100 Hz RBW 1 Hz VBW (Option 1DR) (typical) |
| 1 MHz to 10 MHz | | | ≤ -117 dBm | ≤ -127 dBm |
| 10 MHz to 1.0 GHz | ≤ -116 dBm | ≤ -124 dBm | ≤ -119 dBm | ≤ -129 dBm |
| 1.0 GHz to 2.0 GHz | ≤ -115 dBm | ≤ -123 dBm | ≤ -120 dBm | ≤ -130 dBm |
| 2.0 GHz to 3.0 GHz | ≤ -112 dBm | ≤ -120 dBm | ≤ -118 dBm | ≤ -128 dBm |
| 3.0 GHz to 6.0 GHz | ≤ -112 dBm | ≤ -120 dBm | ≤ -118 dBm | ≤ -128 dBm |
| 6.0 GHz to 12 GHz | ≤ -110 dBm | ≤ -118 dBm | ≤ -117 dBm | ≤ -127 dBm |
| 12 GHz to 22 GHz | ≤ -107 dBm | ≤ -115 dBm | ≤ -114 dBm | ≤ -124 dBm |
| 22 GHz to 26.5 GHz | ≤ -101 dBm | ≤ -109 dBm | ≤ -112 dBm | ≤ -122 dBm |

| | Specifications | Supplemental Information |
|---------------------------|---|--------------------------|
| Display Range | | |
| Log Scale | Ten divisions displayed; 0.1, 0.2, 0.5 dB/division and 1 to 20 dB/division in 1 dB steps | |
| RBW ≥ 1 kHz | Calibrated 0 to -85 dB from Reference Level | |
| RBW ≤ 300 Hz (Option 1DR) | Calibrated 0 to -120 dB ^a from Reference Level | |
| Linear Scale | Ten divisions | |
| Scale Units | dBm, dBmV, dBμV, dBμA, A, V, and W | |

a. 0 to -70 dB range when span = 0 Hz, or when IF Gain fixed:
(:DISPlay:WINDow:TRACe:Y[:SCALE]:LOG:RANGE:AUTO OFF).

| | Specifications | Supplemental Information |
|---|--------------------------|--------------------------|
| Marker Readout Resolution | | |
| Log scale | | |
| RBW \geq 1 kHz | | |
| 0 to -85 dB from ref level | 0.04 dB | |
| RBW \leq 300 Hz (<i>Option 1DR</i>) | | |
| 0 to -120 dB from ref level | 0.04 dB | |
| Linear scale | 0.01% of Reference Level | |

| | Specifications | Supplemental Information |
|---|----------------|--------------------------|
| Frequency Response | | |
| Absolute ^a /Relative | | |
| 10 dB attenuation | | |
| 9 kHz to 3.0 GHz | | |
| 20 to 30 °C | ± 0.5 dB | |
| 0 to 55 °C | ± 1.0 dB | |
| Preselector centered for frequency >3.0 GHz | | |
| 10 dB attenuation | | |
| 3.0 GHz to 6.7 GHz | | |
| Absolute ^a | | |
| 20 to 30 °C | ± 1.5 dB | |
| 0 to 55 °C | ± 2.5 dB | |
| Relative | | |
| 20 to 30 °C | ± 1.3 dB | |
| 0 to 55 °C | ± 1.5 dB | |
| 6.7 GHz to 13.2 GHz | | |
| Absolute ^a | | |
| 20 to 30 °C | ± 2.0 dB | |
| 0 to 55 °C | ± 3.0 dB | |

| | Specifications | Supplemental Information |
|-----------------------|----------------|--------------------------|
| Relative | | |
| 20 to 30 °C | ±1.8 dB | |
| 0 to 55 °C | ±2.0 dB | |
| 13.2 GHz to 26.5 GHz | | |
| Absolute ^a | | |
| 20 to 30 °C | ±2.0 dB | |
| 0 to 55 °C | ±3.0 dB | |
| Relative | | |
| 20 to 30 °C | ±1.8 dB | |
| 0 to 55 °C | ±2.0 dB | |

a. Absolute frequency response values are referenced to the amplitude at 50 MHz.

| | Specifications | Supplemental Information |
|--|---------------------------------------|--------------------------|
| Input Attenuation Switching Uncertainty at 50 MHz | | |
| Attenuator Setting | | |
| 0 dB to 5 dB | ±0.3 dB | |
| 10 dB | Reference | |
| 15 dB | ±0.3 dB | |
| 20 to 65 dB attenuation | ±(0.1 dB + 0.01 × Attenuator Setting) | |

| Attenuation Accuracy Relative to the 10 dB Attenuator Setting, Characteristic | | | | | |
|---|-----------------|--------------|-------------|-----------|-------------|
| Attenuation | Frequency Range | | | | |
| | dc-3 GHz | 3.0-13.2 GHz | 13.2-19 GHz | 19-22 GHz | 22-26.5 GHz |
| 0 dB | ±0.3 dB | ±0.5 dB | ±0.8 dB | ±0.9 dB | ±1.0 dB |
| 5 dB | ±0.3 dB | ±0.5 dB | ±0.8 dB | ±0.9 dB | ±1.0 dB |
| 10 dB | Reference | Reference | Reference | Reference | Reference |
| 15 dB | ±0.4 dB | ±0.5 dB | ±0.8 dB | ±1.0 dB | ±1.5 dB |
| 20 dB | ±0.4 dB | ±0.5 dB | ±0.8 dB | ±1.0 dB | ±1.5 dB |
| 25 dB | ±0.5 dB | ±0.6 dB | ±0.8 dB | ±1.2 dB | ±2.0 dB |
| 30 dB | ±0.5 dB | ±0.6 dB | ±0.8 dB | ±1.2 dB | ±2.0 dB |
| 35 dB | ±0.6 dB | ±0.7 dB | ±1.0 dB | ±1.8 dB | ±3.0 dB |
| 40 dB | ±0.6 dB | ±0.7 dB | ±1.0 dB | ±1.8 dB | ±3.0 dB |
| 45 dB | ±0.7 dB | ±1.0 dB | ±1.3 dB | ±2.2 dB | ±3.4 dB |
| 50 dB | ±0.7 dB | ±1.0 dB | ±1.3 dB | ±2.2 dB | ±3.4 dB |
| 55 dB | ±0.9 dB | ±1.1 dB | ±1.6 dB | ±2.7 dB | ±3.5 dB |
| 60 dB | ±0.9 dB | ±1.1 dB | ±1.6 dB | ±2.7 dB | ±3.5 dB |
| 65 dB | ±1.0 dB | ±1.6 dB | ±2.0 dB | ±3.2 dB | ±3.8 dB |

| | Specifications | Supplemental Information |
|--|--|--------------------------|
| Absolute Amplitude Accuracy | | |
| At reference settings ^a | ±0.4 dB | |
| Overall Amplitude Accuracy ^b 20 to 30 °C | ± (0.6 dB + Absolute Frequency Response) | |

- a. Settings are: reference level -20 dBm; input attenuation 10 dB; center frequency 50 MHz; RBW 1 kHz; VBW 1 kHz; amplitude scale linear or log; span 2 kHz; sweep time coupled, signal at reference level.
- b. For reference level 0 to -50 dBm; input attenuation 10 dB; RBW 1 kHz; VBW 1 kHz; amplitude scale log, log range 0 to -50 dB from reference level; sweep time coupled; signal input 0 to -50 dBm; span ≤20 kHz.

| | Specifications | Supplemental Information | |
|---|--------------------------------|--------------------------|--|
| RF Input VSWR (at tuned frequency) | Attenuator setting 0 dB | ≤3.0:1, characteristic | |
| | 9 kHz to 26.5 GHz | | |
| | Attenuator setting 5 dB | ≤2.0:1, characteristic | |
| | 9 kHz to 100 kHz | | |
| | 100 kHz to 6.7 GHz | ≤1.4:1, characteristic | |
| | 6.7 GHz to 13.2 GHz | | |
| | 13.2 GHz to 22.0 GHz | ≤2.3:1, characteristic | |
| | 22.0 GHz to 26.5 GHz | | |
| | Attenuator setting 10 to 65 dB | ≤1.3:1, characteristic | |
| | 9 kHz to 6.7 GHz | | |
| 6.7 GHz to 13.2 GHz | ≤1.5:1, characteristic | | |
| 13.2 GHz to 22.0 GHz | | | |
| 22.0 GHz to 26.5 GHz | ≤2.0:1, characteristic | | |
| | | ≤2.2:1, characteristic | |

| | Specifications | Supplemental Information | |
|-----------------------------------|----------------|--------------------------|--|
| Auto Alignment^a | | | |
| Sweep-to-sweep variation | | ±0.1 dB, characteristic | |

a. Set **Auto Align** to **Off** and use **Align Now, All** to eliminate this variation.

| | Specifications | Supplemental Information |
|---|----------------|--------------------------|
| Resolution Bandwidth Switching Uncertainty (at Reference Level) | | |
| 1 kHz RBW | Reference | |
| 3 kHz to 3 MHz RBW | ± 0.3 dB | |
| 5 MHz RBW | ± 0.6 dB | |
| 100 Hz to 300 Hz RBW (Option 1DR) | ± 0.3 dB | |

| | Specifications | Supplemental Information |
|--|--|--------------------------|
| Reference Level | | |
| Range | -149.9 dBm to maximum mixer level + attenuator setting | |
| Resolution | | |
| Log Scale | ± 0.1 dB | |
| Linear Scale | $\pm 0.12\%$ of Reference Level | |
| Accuracy (at a fixed frequency, a fixed attenuator, and referenced to -30 dBm) | | |
| Reference Level (dBm) – input attenuator setting (dB) | | |
| -10 dBm to > -60 dBm | ± 0.3 dB | |
| -60 dBm to > -85 dBm | ± 0.5 dB | |
| -85 dBm to -90 dBm | ± 0.7 dB | |

| | Specifications | Supplemental Information |
|--|----------------------------------|--------------------------|
| Display Scale Switching Uncertainty | | |
| Switching between Linear and Log | ± 0.15 dB at reference level | |
| Log Scale Switching | No error | |

| | Specifications | Supplemental Information |
|---|---|--------------------------------------|
| Display Scale Fidelity | | |
| Log Maximum Cumulative | | |
| RBW \geq 1 kHz | | |
| 0 to 85 dB Below Reference Level | $\pm(0.3 \text{ dB} + 0.01 \times \text{dB from reference level})$ | |
| RBW \leq 300 Hz (<i>Option 1DR</i>) | | |
| Span > 0 Hz | | |
| Auto range On | | |
| 0 to 98 dB ^a below reference level | $\pm(0.3 \text{ dB} + 0.01 \times \text{dB from reference level})$ | |
| > 98 to 120 dB below reference level | | $\pm 2.0 \text{ dB, characteristic}$ |
| Auto range Off ^b | | |
| 0 to 60 dB ^a below reference level | $\pm(0.3 \text{ dB} + 0.015 \times \text{dB from reference level})$ | |
| > 60 to 70 dB below reference level | $\pm 1.5 \text{ dB}$ | |
| Span = 0 Hz | | |
| 0 to 60 dB ^a below reference level | $\pm(0.3 \text{ dB} + 0.015 \times \text{dB from reference level})$ | |
| > 60 to 70 dB below reference level | $\pm 1.5 \text{ dB}$ | |
| Log Incremental Accuracy | | |
| 0 to 80 dB ^{a,c} below reference level | $\pm 0.4 \text{ dB}/4 \text{ dB}$ | |
| Linear Accuracy | $\pm 2\%$ of Reference Level | |

a. 0 to 30 dB for RBW = 200 Hz

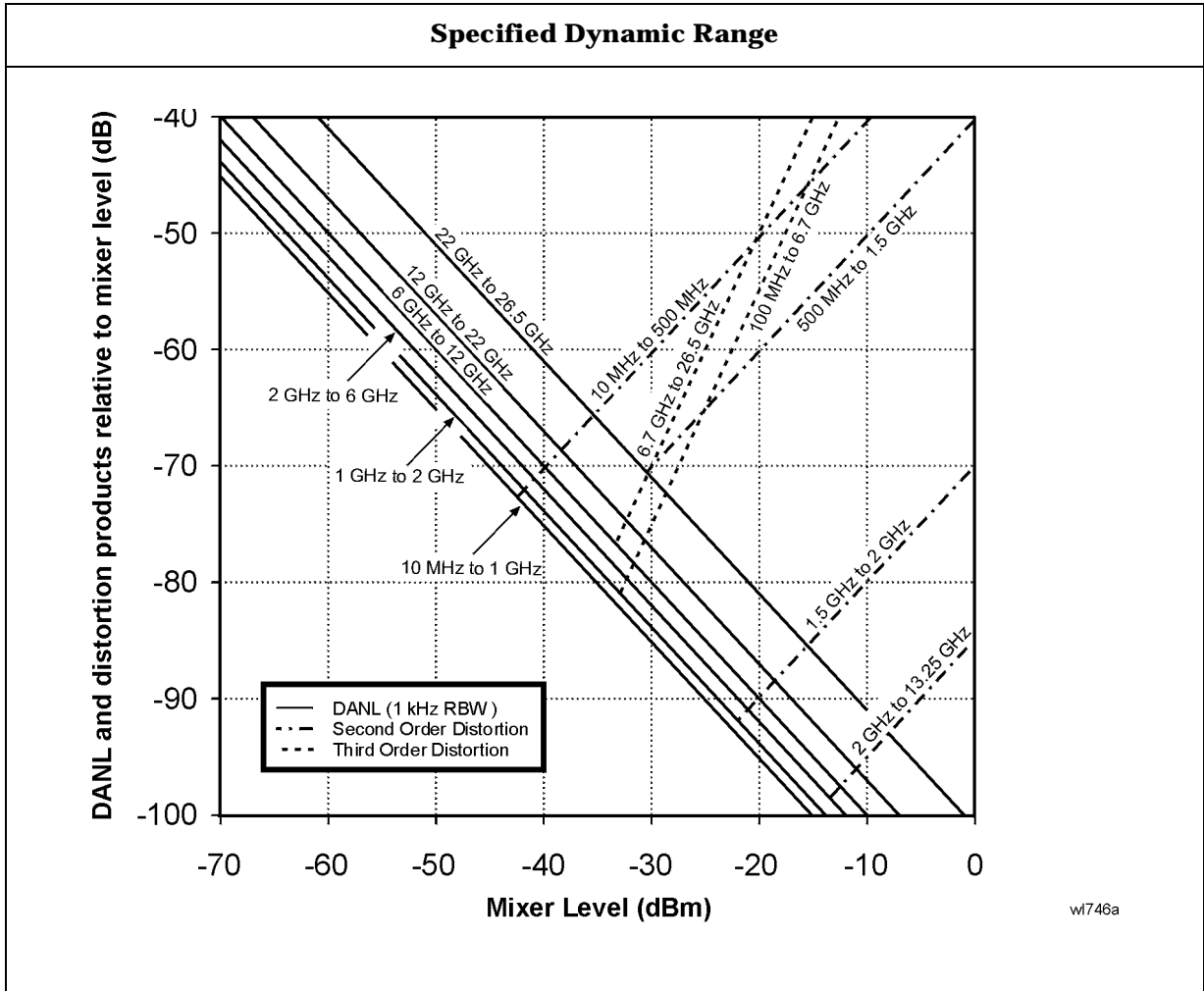
b. The SCPI command for auto range off is:
(:DISPlay:WINDow:TRACe:Y[:SCALe]:LOG:RANGe:AUTO OFF)

c. 0 to 50 dB for RBWs \leq 300 Hz and span = 0 Hz, or when auto ranging is off.

| | Specifications | Supplemental Information |
|--|--|--|
| Spurious Responses | | |
| Second Harmonic Distortion | | |
| Input Signal | | |
| 10 MHz to 500 MHz | < -60 dBc for -30 dBm signal at input mixer ^a | +30 dBm SHI (second harmonic intercept) |
| 500 MHz to 1.5 GHz | < -70 dBc for -30 dBm signal at input mixer ^a | +40 dBm SHI |
| 1.5 GHz to 2.0 GHz | < -80 dBc for -10 dBm signal at input mixer ^a | +70 dBm SHI |
| 2.0 GHz to 3.35 GHz | < -95 dBc ^b for -10 dBm signal at input mixer ^a | +85 dBm SHI |
| 3.35 GHz to 6.6 GHz | < -95 dBc ^b for -10 dBm signal at input mixer ^a | +85 dBm SHI |
| 6.6 GHz to 13.25 GHz | < -95 dBc ^b for -10 dBm signal at input mixer ^a | +85 dBm SHI |
| Third Order Intermodulation Distortion | | |
| 10 MHz to 100 MHz | | +5 dBm TOI (third order intercept), characteristic |
| 100 MHz to 3 GHz | < -75 dBc for two -30 dBm signals at input mixer ^a and >50 kHz separation | +7.5 dBm TOI |
| 3.0 GHz to 6.7 GHz | < -75 dBc for two -30 dBm signals at input mixer ^a and >50 kHz separation | +7.5 dBm TOI |
| 6.7 GHz to 13.2 GHz | < -70 dBc for two -30 dBm signals at input mixer ^a and >50 kHz separation | +5.0 dBm TOI |
| 13.2 GHz to 26.5 GHz | < -70 dBc for two -30 dBm signals at input mixer ^a and >50 kHz separation | +5.0 dBm TOI |
| Other Input Related Spurious | | |
| Inband Responses | | |
| >30 kHz offset | < -65 dBc for -20 dBm signal at input mixer ^a | |

| | Specifications | Supplemental Information |
|-----------------------|--|--------------------------|
| Out-of-band Responses | < -80 dBc for -10 dBm signal at input mixer ^a | |

- a. Mixer power level (dBm) = input power (dBm) - input attenuation (dB)
- b. or signal below displayed average noise level.



Agilent E4408B Specifications and Characteristics

| | Specifications | Supplemental Information |
|---|----------------|--------------------------|
| Residual Responses (Input terminated and 0 dB attenuation) 150 kHz to 6.7 GHz | < -90 dBm | |

Options

Tracking Generator (Option 1DN)

The spectrum analyzer/tracking generator combination will meet its specification after a cable (8120-5148) and adapter are connected between RF OUT and INPUT and **Align Now, TG** has been run.

| | Specifications | Supplemental Information |
|----------------|----------------|--------------------------|
| Warm-up | 5 minutes | |

| | Specifications | Supplemental Information |
|-------------------------------|------------------|--------------------------|
| Output Frequency Range | 9 kHz to 3.0 GHz | |

| | Specifications | Supplemental Information |
|------------------------------|----------------|--|
| Minimum Resolution BW | 1 kHz | Not usable with resolution bandwidths ≤ 300 Hz (<i>Option 1DR</i>) |

| | Specifications | Supplemental Information |
|---|--------------------------|--------------------------|
| Output Power Level | | |
| Range | -2 to -66 dBm | |
| Resolution | 0.1 dB | |
| Absolute Accuracy (at 50 MHz with coupled source attenuator, referenced to -20 dBm) | ± 0.75 dB | |
| Vernier | | |
| Range | 8 dB | |
| Accuracy (with coupled source attenuator, 50 MHz, -20 dBm) | | |
| Incremental | ± 0.2 dB/dB | |
| Cumulative | ± 0.5 dB, total | |
| Output Attenuator Range | 0 to 56 dB in 8 dB steps | |

| | Specifications | Supplemental Information |
|-----------------------------------|----------------|---------------------------------------|
| Maximum Safe Reverse Level | | +30 dBm (1 W), 50 Vdc, characteristic |

| | Specifications | Supplemental Information |
|---------------------------|---|--------------------------|
| Output Power Sweep | | |
| Range | (-10 to -2 dBm) – (Source Attenuator Setting) | |
| Resolution | 0.1 dB | |
| Accuracy (zero span) | <1 dB peak-to-peak | |

| | Specifications | Supplemental Information |
|-------------------------------|----------------|--------------------------|
| Output Flatness | | |
| Referenced to 50 MHz, -20 dBm | | |
| 9 kHz to 10 MHz | ±3 dB | |
| 10 MHz to 3 GHz | ±2 dB | |

| | Specifications | Supplemental Information |
|---|----------------|--------------------------|
| Spurious Outputs | | |
| (-2 dBm output) | | |
| Harmonic Spurs | | |
| TG Output 9 kHz to 20 kHz | ≤ -15 dBc | |
| TG Output 20 kHz to 3 GHz | ≤ -25 dBc | |
| Non-harmonic Spurs | | |
| TG Output 9 kHz to 2 GHz | ≤ -27 dBc | |
| TG Output 2 GHz to 3 GHz | ≤ -23 dBc | |
| LO Feedthrough | | |
| LO Frequency 3.921409 GHz to 6.9214 GHz | ≤ -16 dBm | |

| | Specifications | Supplemental Information |
|----------------------|---|---------------------------------|
| Dynamic Range | Maximum Output Power Level – Displayed Average Noise Level | |

| | Specifications | Supplemental Information |
|------------------------|-----------------------|--|
| Output Tracking | | |
| Drift | | 1.5 kHz/5 minute, characteristic |
| Swept Tracking Error | | Usable in 1 kHz RBW after 5 minutes of warm-up |

| | Specifications | Supplemental Information |
|-------------------------------|-----------------------|---------------------------------|
| RF Power-Off Residuals | | |
| 9 kHz to 3 GHz | | < –120 dBm, characteristic |

| | Specifications | Supplemental Information |
|--|-----------------------|---------------------------------|
| Output Attenuator Repeatability | | |
| 9 kHz to 300 MHz | | ±0.1 dB, characteristic |
| 300 MHz to 2 GHz | | ±0.2 dB, characteristic |
| 2 GHz to 3 GHz | | ±0.3 dB, characteristic |

| | Specifications | Supplemental Information |
|--------------------|-----------------------|---------------------------------|
| Output VSWR | | |
| 0 dB attenuation | | <2.0:1, characteristic |
| ≥ 8 dB attenuation | | <1.5:1, characteristic |

| | Specifications | Supplemental Information |
|-----------------------------------|----------------|--------------------------|
| Output Attenuator Accuracy | | |
| 0 dB | Reference | ±0.5 dB, characteristic |
| 8 dB | | ±0.5 dB, characteristic |
| 16 dB | | |
| 24 dB | | ±0.5 dB, characteristic |
| 32 dB | | ±0.6 dB, characteristic |
| 40 dB | | ±0.8 dB, characteristic |
| 48 dB | | ±1.0 dB, characteristic |
| 56 dB | | ±1.1 dB, characteristic |

| |
|--|
| Tracking Generator Output Accuracy |
| Relative Accuracy (Referred to -20 dBm) = Output Attenuator Accuracy + Vernier Accuracy + Output Flatness |
| Absolute Accuracy = Relative Accuracy (Referred to -20 dBm) + Absolute Accuracy at 50 MHz |

General

| | Specifications | Supplemental Information |
|--------------------------|----------------|--------------------------|
| Temperature Range | | |
| Operating | 0 to 55 °C | Floppy disk 10 to 40 °C |
| Storage | -40 to 75 °C | |

| | Specifications | Supplemental Information |
|---------------------------------|----------------|----------------------------|
| Audible Noise (ISO 7779) | | |
| Sound Pressure at 25 °C | | <40 dBa, (<4.6 Bels power) |

| | Specifications | Supplemental Information |
|-------------------------------|---|--------------------------|
| Military Specification | Has been type tested to the environmental specifications of MIL-PRF-28800F class 3. | |

| | Specifications | Supplemental Information |
|--------------------------|---|--------------------------|
| EMI Compatibility | Conducted and radiated emission is in compliance with CISPR Pub. 11/1990 Group 1 Class A. | |

| | Specifications | Supplemental Information |
|-------------------------|----------------|---|
| Immunity Testing | | |
| Radiated Immunity | | Testing was done at 3 V/m according to IEC 801-3/1984. When the analyzer tuned frequency is identical to the immunity test signal frequency, there may be signals of up to -60 dBm displayed on the screen. |
| Electrostatic Discharge | | Air discharges of up to 8 kV were applied according to IEC 801-2/1991. Discharges to center pins of any of the connectors may cause damage to the associated circuitry. |

| | Specifications | Supplemental Information |
|----------------------------|--|--------------------------|
| Power Requirements | | |
| ac Operation | | |
| Voltage, frequency | 90 to 132 Vrms, 47 to 440 Hz 195 to 250 Vrms, 47 to 66 Hz | |
| Power Consumption, On | <300 W | |
| Power Consumption, Standby | <5 W | |
| dc Operation | | |
| Voltage | 12 to 20 Vdc | |
| Power Consumption | <200 W | |
| Power Consumption, Standby | <100 mW | |

| | Specifications | Supplemental Information |
|---|----------------|--------------------------|
| Measurement Speed | | |
| Local Measurement and Display Update rate ^a | | ≥ 28/s, characteristic |
| Remote Measurement and GPIB Transfer Rate ^{b,c} (Option A4H) | | ≥ 28/s, characteristic |
| RF Center Frequency Tune, Measure, and GPIB Transfer Time ^{b,d} (Option A4H) | | ≤ 90 ms, characteristic |

- a. Factory preset, auto align Off, fixed center frequency, RBW = 1 MHz, spans >10 MHz and ≤600 MHz, and stop frequency ≤3 GHz.
- b. Display Off (:DISPlay:ENABle OFF), and 32-bit integer data format (:FORMat:DATA INT,32), if *Option A4J* is installed, disable sweep ramp, (:SYS-Tem:PORTs:IFVSweep:ENABle OFF), markers Off, single sweep, measured with IBM compatible PC with 550 MHz Pentium® III running Windows® NT 4.0, one meter GPIB cable, National Instruments PCI-GPIB card and NI-488.2 DLL
- c. Factory preset, auto align Off, fixed center frequency, RBW = 1 MHz, and span = 20 MHz, stop frequency ≤3 GHz, average of 100 measurements.
- d. Factory preset, auto align Off, RBW = 1 MHz, span = 20 MHz, stop frequency ≤3 GHz, center frequency tune step size = 50 MHz.

| | Specifications | Supplemental Information |
|---------------------------|----------------|---|
| Data Storage | | |
| Internal ^a | | 8.0 MB, nominal |
| External (10 to 40 °C) | | 3.5" 1.44 MB, MS-DOS [®] compatible floppy disk |

a. For serial numbers prior to US41440000 or MY41440000, 1 MB without Option B72, 8 MB with Option B72.

| | Specifications | Supplemental Information |
|------------------------------------|----------------|------------------------------|
| Memory Usage | | |
| State | | 20 kB ^a , nominal |
| State plus 401-point trace | | 21 kB ^a , nominal |
| Applications memory usage | | |
| 8590 Compatibility (Option 290) | | 0.7 MB, nominal |

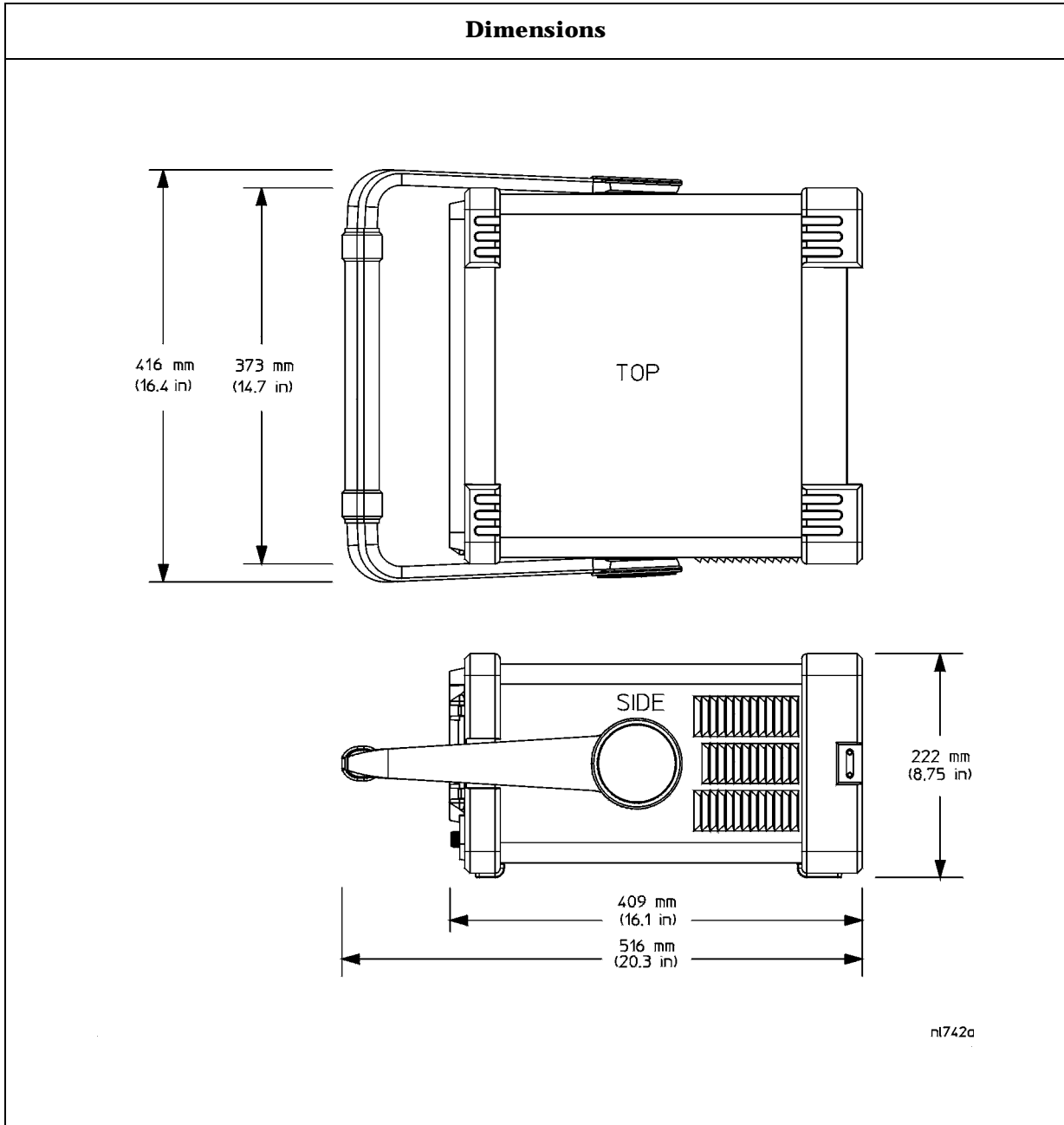
a. The size of state will increase depending on installed applications.

| | Specifications | Supplemental Information |
|------------------------------|----------------|---|
| Demod Tune and Listen | | |
| Demod (Option A4J) | AM | Internal speaker, front-panel earphone jack and front-panel volume control. An uncalibrated demodulated signal is available on the AUX VIDEO OUT connector at the rear panel. |

| | Specifications | Supplemental Information |
|---------------------------------|----------------|--------------------------------------|
| Weight (without options) | | |
| Net | | 17.1 kg (37.7 lb), characteristic |
| Shipping | | 31.9 kg (70.3 lb), characteristic |

| | Specifications | Supplemental Information |
|----------------------------|----------------|--------------------------|
| Display^a | | |
| Resolution | 640 × 480 | |

- a. The LCD display is manufactured using high precision technology. However, there may be up to six bright points (white, blue, red or green in color) that constantly appear on the LCD screen. These points are normal in the manufacturing process and do not affect the measurement integrity of the product in any way.



Agilent E4408B Specifications and Characteristics

Inputs and Outputs

Front Panel

| | Specifications | Supplemental Information |
|----------------------------------|-------------------------------|--------------------------|
| INPUT 50 Ω | | |
| Connector <i>(Option BAB)</i> | Type-N female APC 3.5 male | |
| Impedance | | 50 Ω, nominal |

| | Specifications | Supplemental Information |
|----------------------------------|----------------|--------------------------|
| RF OUT 50 Ω, (Option 1DN) | | |
| Connector | Type-N female | |
| Impedance | | 50 Ω, nominal |

| | Specifications | Supplemental Information |
|----------------------------------|----------------|--|
| AMPTD REF OUT^a | | Amplitude Reference |
| Connector | BNC female | |
| Impedance | | 50 Ω, nominal |
| Frequency | | 50 MHz |
| Frequency Accuracy | | Frequency reference error ^b |
| 50 Ω Amplitude ^c | | -20 dBm, nominal |

- Turn the amplitude reference on/off by pressing the keys: **Input/Output, Amptd Ref Out**.
- Frequency reference error = (aging rate × period of time since adjustment + settability + temperature stability).
- The internal amplitude reference actual power is stored internally.

| | Specifications | Supplemental Information |
|--------------------|----------------|--|
| PROBE POWER | | |
| Voltage/Current | | +15 Vdc, ±7% at 150 mA max., characteristic -12.6 Vdc ±10% at 150 mA max., characteristic |

| | Specifications | Supplemental Information |
|---------------------------------|----------------|---|
| EXT KEYBOARD^a | | Used for entering screen titles and filenames only. Interface compatible with most IBM-compatible PC keyboards. |
| Connector | 6-pin mini-DIN | |

a. The feature is not implemented in firmware revisions prior to A.04.00.

| | Specifications | Supplemental Information |
|----------------|----------------|----------------------------------|
| Speaker | | Front panel knob controls volume |

| | Specifications | Supplemental Information |
|------------------|--|--|
| Headphone | | Front panel knob controls volume |
| Connector | 3.5 mm (1/8 inch) miniature audio jack | |
| Power Output | | 0.2 W into 4 Ω , characteristic |

Rear Panel

| | Specifications | Supplemental Information |
|-----------------------|----------------|--------------------------|
| 10 MHz REF OUT | | |
| Connector | BNC female | |
| Impedance | | 50 Ω , nominal |
| Output Amplitude | | >0 dBm, characteristic |

| | Specifications | Supplemental Information |
|-----------------------|----------------|---|
| 10 MHz REF IN | | |
| Connector | BNC female | Note: Analyzer noise sidebands and spurious response performance may be affected by the quality of the external reference used. |
| Impedance | | 50 Ω , nominal |
| Input Amplitude Range | | -15 to +10 dBm, characteristic |
| Frequency | | 10 MHz, nominal |

| | Specifications | Supplemental Information |
|------------------------------|----------------|---|
| GATE TRIG/EXT TRIG IN | | |
| Connector | BNC female | |
| External Trigger Input | | |
| Trigger Level | | Selectable positive or negative edge initiates sweep in EXT TRIG mode (5 V TTL) |

| | Specifications | Supplemental Information |
|------------------------|----------------|---|
| GATE/HI SWP OUT | | |
| Connector | BNC female | |
| High Sweep Output | | |
| Level | | High = sweep ^a ; Low = retrace (5 V TTL) |

a. High sweep may be high longer than the indicated sweep times.

| | Specifications | Supplemental Information |
|-------------------|-----------------------------------|---|
| VGA OUTPUT | | |
| Connector | VGA compatible, 15-pin mini D-SUB | |
| Format | | VGA (31.5 kHz horizontal, 60 Hz vertical sync rates, non-interlaced) Analog RGB |
| Resolution | 640 \times 480 | |

| | Specifications | Supplemental Information |
|--|----------------|---------------------------------------|
| AUX IF OUT <i>(Option A4J)</i> | | RBW \geq 1 kHz |
| Connector | BNC female | |
| Frequency | | 21.4 MHz, nominal |
| Amplitude (for signal at reference level and for reference levels – input attenuation of –10 to –70 dBm) | | –10 dBm (uncorrected), characteristic |
| Impedance | | 50 Ω , nominal |

| | Specifications | Supplemental Information |
|---|----------------|--|
| AUX VIDEO OUT <i>(Option A4J)</i> | | RBW \geq 1 kHz |
| Connector | BNC female | |
| Amplitude Range (into >10 k Ω) | | 0 to 1 V (uncorrected), characteristic |

| | Specifications | Supplemental Information |
|---|----------------|--|
| HI SWP IN <i>(Option A4J)</i> | | |
| Connector | BNC female | |
| Input | | Open collector, low resets and holds the sweep (5 V TTL) |

| | Specifications | Supplemental Information |
|--|----------------|---|
| HI SWP OUT <i>(Option A4J)</i> | | |
| Connector | BNC female | |
| Output | | High = sweep ^a , Low = retrace (5 V TTL) |

a. High sweep may be high longer than the indicated sweep times.

| | Specifications | Supplemental Information |
|---------------------------------------|----------------|---------------------------------|
| SWP OUT <i>(Option A4J)</i> | | |
| Connector | BNC female | |
| Amplitude | | 0 to +10 V ramp, characteristic |

| | Specifications | Supplemental Information |
|-----------------------------|----------------|--|
| PRESEL TUNE OUTPUT | | |
| Connector | BNC female | |
| Load Impedance (dc coupled) | | > 10 k Ω , nominal |
| Range | | 0 to +10 V, characteristic |
| Sensitivity | | 0.33 V/GHz of tuned frequency > 3 GHz, characteristic |

| | Specifications | Supplemental Information |
|--|------------------------|--|
| GPIB Interface <i>(Option A4H)</i> | | |
| Connector | IEEE-488 bus connector | |
| GPIB Codes | | SH1, AH1, T6, SR1, RL1, PP0, DC1, C1, C2, C3 and C28 |

| | Specifications | Supplemental Information |
|--|------------------|--------------------------|
| Serial Interface <i>(Option 1AX)</i> | | |
| Connector | 9-pin D-SUB male | RS-232 |

| | Specifications | Supplemental Information |
|---|---------------------|--------------------------|
| Parallel Interface <i>(Option A4H or 1AX)</i> | | Printer port only |
| Connector | 25-pin D-SUB female | |

Regulatory Information

CAUTION This product is designed for use in Installation Category II and Pollution Degree 2 per IEC 1010 and 664 respectively.

NOTE This product has been designed and tested in accordance with IEC Publication 1010, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the product in a safe condition.



The CE mark is a registered trademark of the European Community (if accompanied by a year, it is the year when the design was proven).



The CSA mark is the Canadian Standards Association safety mark.

ISM 1-A

This is a symbol of an Industrial Scientific and Medical Group 1 Class A product. (CISPR 11, Clause 4)

Declaration of Conformity

DECLARATION OF CONFORMITY

According to ISO/IEC Guide 22 and CEN/CENELEC EN 45014

Manufacturer's Name: Agilent Technologies, Inc.

Manufacturer's Address: 1400 Fountaingrove Parkway
Santa Rosa, CA 95403-1799
USA

Declares that the products

Product Name: Spectrum Analyzer

Model Number: E4401B, E4402B, E4403B, E4404B,
E4405B, E4407B, E4408B, E4411B

Product Options: This declaration covers all options of the above products.

Conform to the following product specifications:

EMC: IEC 61326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998

| <u>Standard</u> | <u>Limit</u> |
|--|-------------------------|
| CISPR 11:1990 / EN 55011-1991 | Group 1, Class A |
| IEC 61000-4-2:1995+A1998 / EN 61000-4-2:1995 | 4 kV CD, 8 kV AD |
| IEC 61000-4-3:1995 / EN 61000-4-3:1995 | 3 V/m, 80 - 1000 MHz |
| IEC 61000-4-4:1995 / EN 61000-4-4:1995 | 0.5 kV sig., 1 kV power |
| IEC 61000-4-5:1995 / EN 61000-4-5:1996 | 0.5 kV L-L, 1 kV L-G |
| IEC 61000-4-6:1996 / EN 61000-4-6:1998 | 3 V, 0.15 - 80 MHz |
| IEC 61000-4-11:1994 / EN 61000-4-11:1998 | 1 cycle, 100% |

Safety: IEC 61010-1:1990 + A1:1992 + A2:1995 / EN 61010-1:1993 +A2:1995
CAN/CSA-C22.2 No. 1010.1-92

Supplementary Information:

The products herewith comply with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC and carry the CE-marking accordingly.



Santa Rosa, CA, USA 17 April 2000

Greg Pfeiffer/Quality Engineering Manager

For further information, please contact your local Agilent Technologies sales office, agent or distributor.

About This Chapter

This chapter contains specifications and characteristics for the Agilent E4411B spectrum analyzer. The distinction between specifications and characteristics is described as follows.

- Specifications describe the performance of parameters covered by the product warranty. (The temperature range is 0 °C to 55 °C, unless otherwise noted.)
- Characteristics describe product performance that is useful in the application of the product, but is not covered by the product warranty.
- Typical performance describes additional product performance information that is not covered by the product warranty. It is performance beyond specification that 80% of the units exhibit with a 95% confidence level over the temperature range 20 to 30 °C. Typical performance does not include measurement uncertainty.
- Nominal values indicate the expected performance, or describe product performance that is useful in the application of the product, but is not covered by the product warranty.

The following conditions must be met for the analyzer to meet its specifications.

- o The analyzer is within the one year calibration cycle.
- o If **Auto Align All** is selected:
 - After 2 hours of storage within the operating temperature range.
 - 5 minutes after the analyzer is turned on with sweep times less than 4 seconds.
- o If **Auto Align Off** is selected:
 - When the analyzer is at a constant temperature, within the operating temperature range, for a minimum of 90 minutes.
 - After the analyzer is turned on for a minimum of 90 minutes and **Align Now All** has been run.
 - When **Align Now All** is run:
 - Every hour
 - If the ambient temperature changes more than 3 °C
 - If the 10 MHz reference changes

- o If **Auto Align All but RF** is selected:
 - When the analyzer is at a constant temperature, within the operating temperature range, for a minimum of 90 minutes.
 - After the analyzer is turned on for a minimum of 90 minutes and **Align Now RF** has been run.
 - When **Align Now RF** is run:
 - Every hour
 - If the ambient temperature changes more than 3 °C

Frequency

| | Specifications | Supplemental Information |
|-----------------------------------|------------------|--------------------------|
| Frequency Range | | |
| 50 Ω | 9 kHz to 1.5 GHz | |
| 75 Ω (<i>Option 1DP</i>) | 1 MHz to 1.5 GHz | |

| | Specifications | Supplemental Information |
|----------------------------|------------------------------|---|
| Frequency Reference | | |
| Aging Rate | $\pm 2 \times 10^{-6}$ /year | $\pm 1.0 \times 10^{-7}$ /day, characteristic |
| Settability | $\pm 5 \times 10^{-7}$ | |
| Temperature Stability | $\pm 5 \times 10^{-6}$ | |

| | Specifications | Supplemental Information |
|-----------------------------------|---|--------------------------|
| Frequency Readout Accuracy | | |
| (Start, Stop, Center, Marker) | $\pm((\text{frequency indication} \times \text{frequency reference error}^a) + 0.75\% \text{ of span} + 15\% \text{ of RBW} + 10 \text{ Hz})$ | |

a. Frequency reference error = (aging rate \times period of time since adjustment + settability + temperature stability).

| | Specifications | Supplemental Information |
|---------------------------------|--|--------------------------|
| Marker Frequency Counter | | |
| Resolution | Selectable from 1 Hz to 100 kHz | |
| Accuracy ^a | $\pm(\text{marker frequency} \times \text{frequency reference error}^b + \text{counter resolution})$ | |

a. Marker level to displayed noise level > 25 dB, RBW/ Span \geq 0.002, frequency offset = 0 Hz.

b. Frequency reference error = (aging rate \times period of time since adjustment + settability + temperature stability).

| | Specifications | Supplemental Information |
|-----------------------|-------------------------------------|--------------------------|
| Frequency Span | | |
| Range | 0 Hz (zero span), 100 Hz to 1.5 GHz | |
| Resolution | 2 Hz | |
| Accuracy | ±1.0% of span | |

| | Specifications | Supplemental Information |
|--|--|--|
| Sweep Time | | |
| Range | 4 ms to 4000 s ^a | |
| Tracking Generator On (Option 1DN or 1DQ) | | 50 ms is the minimum sweep time |
| Accuracy (Span = 0 Hz) | | |
| 4 ms to 4000 s ^a | ±1% | |
| Sweep Trigger ^b | Free Run, Single, Line, Video ^c , External, Delayed, Offset ^d | |
| Delayed Trigger ^e | | |
| Range | 1 μs to 400 s | |
| Resolution | $\frac{\text{delay in seconds}}{65000}$ rounded up to nearest μs | |
| Accuracy | ±(500 ns + (0.01% of delay)) | |
| Offset Trigger ^d | | |
| Resolution | $\frac{\text{sweep time}}{400}$ | |
| Range | ±327 ms to ±323 ks | Where ST = sweep time $\frac{-32766 \times ST}{400}$ to $\frac{32365 \times ST}{400}$ |

- a. For firmware revisions prior to A.04.00, 5 ms to 2000 s.
- b. Auto align is suspended in video, external, and delayed trigger modes while waiting for a trigger event to occur.
- c. Unavailable when RBW ≤ 300 Hz (Option 1DR).
- d. For firmware revision A.04.00 or later.
- e. Delayed trigger is available with line and external trigger.

| | Specifications | Supplemental Information |
|-----------------------------|----------------|--------------------------|
| Sweep (trace) Points | 401 | |

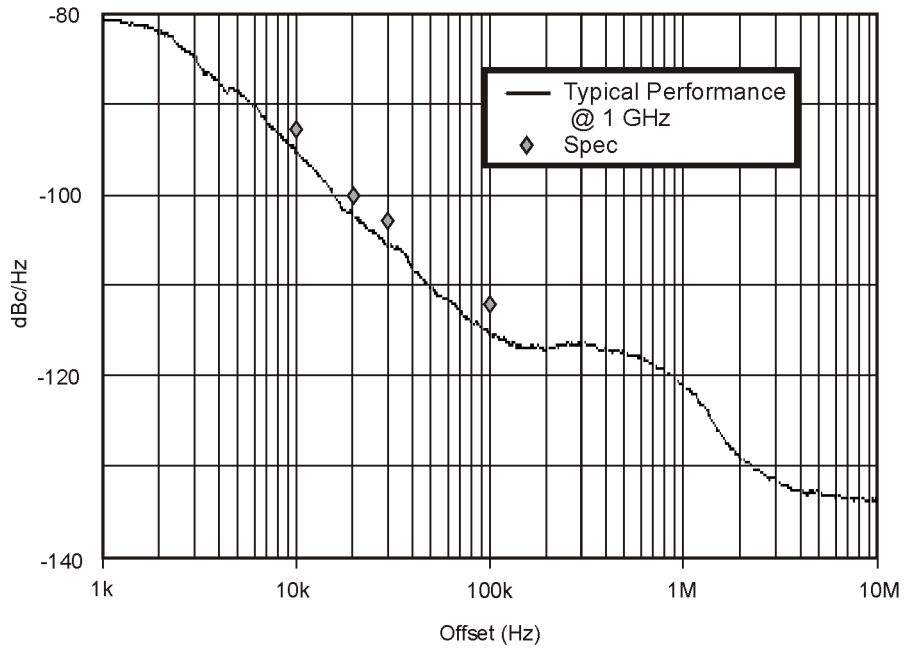
| | Specifications | Supplemental Information |
|--|---|--|
| Resolution Bandwidth (RBW) | | |
| Range | | |
| -3 dB bandwidth | 1 kHz to 3 MHz, in 1-3-10 sequence, 5 MHz | |
| <i>(Option 1DR)</i> | Adds 100, 300 Hz ^a | |
| -6 dB bandwidth (EMI) | 9 kHz and 120 kHz | |
| <i>(Option 1DR)</i> | Add 200 Hz ^a | |
| Accuracy | | |
| 100 Hz to 300 Hz (-3 dB) RBW | ±10% | |
| <i>(Option 1DR)</i> | | |
| 1 kHz to 3 MHz (-3 dB) RBW | ±15% | |
| 5 MHz (-3 dB) RBW | ±30% | |
| 9 kHz, 120 kHz (-6 dB) RBW (EMI) | ±20% | |
| 200 Hz (-6 dB) RBW (EMI) <i>(Option 1DR)</i> | ±10% | |
| Shape | | |
| 100 Hz to 300 Hz RBW <i>(Option 1DR)</i> | | Digital, approximately Gaussian shape |
| 1 kHz to 5 MHz RBW | | Synchronously tuned four poles, approximately Gaussian shape |
| Selectivity (60 dB/3 dB bandwidth ratio) | | |
| 100 Hz to 300 Hz RBW <i>(Option 1DR)</i> | | <5:1, nominal |
| 1 kHz to 5 MHz RBW | | <15:1, nominal |

a. Only available in spans ≤5 MHz, sweep times ≥ 4 ms, and not usable with tracking generator on *(Option 1DN, or Option 1DQ)*.

| | Specifications | Supplemental Information |
|--|-----------------------------------|---|
| Video Bandwidth (VBW) (-3 dB) | | |
| Range | 30 Hz to 1 MHz in 1-3-10 sequence | 3 MHz, characteristic |
| <i>(Option 1DR)</i> | Adds 1, 3, 10 Hz for RBW's <1 kHz | |
| Accuracy | | ±30%, characteristic |
| Shape | | Post detection, single pole low-pass filter used to average displayed noise |
| | | Video bandwidths below 30 Hz are digital bandwidths with anti-aliasing filtering. |

| | Specifications | Supplemental Information |
|--|-----------------------|-------------------------------------|
| Stability | | |
| Noise Sidebands (Offset from CW signal with 1 kHz RBW, 30 Hz VBW and sample detector) | | |
| ≥1 kHz <i>(Option 1DR)</i> | | ≤ -79 dBc/Hz, typical |
| ≥10 kHz | ≤ -93 dBc/Hz | ≤ -95 dBc/Hz, typical |
| ≥20 kHz | ≤ -100 dBc/Hz | ≤ -102 dBc/Hz, typical |
| ≥30 kHz | ≤ -104 dBc/Hz | ≤ -106 dBc/Hz, typical |
| ≥100 kHz | ≤ -113 dBc/Hz | ≤ -116 dBc/Hz, typical |
| Residual FM | | |
| 1 kHz RBW, 1 kHz VBW | ≤150 Hz p-p in 100 ms | |
| 100 Hz RBW, 100 Hz VBW <i>(Option 1DR)</i> | | ≤30 Hz p-p in 20 ms, characteristic |
| System-Related Sidebands, offset from CW signal | | |
| ≥30 kHz | ≤ -65 dBc | |

Noise Sidebands Normalized to 1 Hz Versus Offset from Carrier



w1720b

Amplitude

Amplitude specifications do not apply for the negative peak detector mode.

| | Specifications | Supplemental Information |
|--------------------------|---|--------------------------|
| Measurement Range | Displayed Average Noise Level to Maximum Safe Input Level | |
| Input Attenuator Range | 0 to 60 dB, in 5 dB steps | |

| | Specifications | Supplemental Information |
|--|------------------|---|
| Maximum Safe Input Level | | |
| Input attenuator setting ≥ 15 dB | | Signals $> +33$ dBm (2 W) or $+79$ dBmV (1 W) (<i>Option 1DP</i>) nominal may trigger input protection, which disconnects the input path. |
| Average Continuous Power or Peak Pulse Power | | |
| 50 Ω | +30 dBm (1 W) | |
| 75 Ω (<i>Option 1DP</i>) | +75 dBmV (0.4 W) | |
| dc | 100 Vdc | dc transients may momentarily trigger input protection. |
| Input attenuator setting < 15 dB | | Signals $> +6$ dBm (4 mW) or $+61$ dBmV (15 mW) (<i>Option 1DP</i>) nominal may trigger input protection, which automatically increases input attenuation to 15 dB. |
| Average Continuous Power or Peak Pulse Power | | |
| 50 Ω | +3 dBm (2 mW) | |
| 75 Ω (<i>Option 1DP</i>) | +59 dBmV (10 mW) | |
| dc | 100 Vdc | dc transients may trigger input protection. |

| | Specifications | Supplemental Information |
|--|----------------------|--------------------------|
| 1 dB Gain Compression Total power at input mixer ^{a,b} 50 MHz to 1.5 GHz 50 Ω 75 Ω (<i>Option 1DP</i>) | 0 dBm +46.75 dBmV | |

- a. Mixer power level (dBm) = input power (dBm) – input attenuation (dB).
 b. For resolution bandwidths 1 kHz to 30 kHz, the maximum input signal amplitude must be ≤ reference level +10 dB. (*Option 1DP: For resolution bandwidths 1 kHz to 30 kHz, the maximum input signal amplitude must be ≤ reference level +5 dB.*)

| | Specifications | | Supplemental Information | |
|--|------------------------|---|-------------------------------------|--|
| Displayed Average Noise Level (Input terminated, 0 dB attenuation, sample detector, Reference Level = -70 dBm) (75 Ω: Reference Level = -21.24 dBmV) 50 Ω 400 kHz to 10 MHz 10 MHz to 500 MHz 500 MHz to 1.0 GHz 1.0 GHz to 1.5 GHz 75 Ω, (<i>Option 1DP</i>) 1 MHz to 10 MHz 10 MHz to 500 MHz 500 MHz to 1.0 GHz 1.0 GHz to 1.5 GHz | 1 kHz RBW 30 Hz VBW | 100 Hz RBW 1 Hz VBW (<i>Option 1DR</i>) | 1 kHz RBW 30 Hz VBW (typical) | 100 Hz RBW 1 Hz VBW (<i>Option 1DR</i>) (typical) |
| | ≤ -115 dBm | ≤ -123 dBm | ≤ -119 dBm | ≤ -129 dBm |
| | ≤ -119 dBm | ≤ -127 dBm | ≤ -121 dBm | ≤ -131 dBm |
| | ≤ -117 dBm | ≤ -125 dBm | ≤ -121 dBm | ≤ -130 dBm |
| | ≤ -113 dBm | ≤ -121 dBm | ≤ -118 dBm | ≤ -128 dBm |
| | ≤ -63 dBmV | ≤ -71 dBmV | ≤ -69 dBmV | ≤ -79 dBmV |
| | ≤ -65 dBmV | ≤ -73 dBmV | ≤ -70 dBmV | ≤ -80 dBmV |
| | ≤ -60 dBmV | ≤ -68 dBmV | ≤ -66 dBmV | ≤ -75 dBmV |
| | ≤ -53 dBmV | ≤ -61 dBmV | ≤ -62 dBmV | ≤ -71 dBmV |

| | Specifications | Supplemental Information |
|---|--|--------------------------|
| Display Range | | |
| Log Scale | Ten divisions displayed; 0.1, 0.2, 0.5 dB/division and 1 to 20 dB/division in 1 dB steps | |
| RBW \geq 1 kHz | Calibrated 0 to -85 dB from Reference Level | |
| RBW \leq 300 Hz (<i>Option 1DR</i>) | Calibrated 0 to -120 dB ^a from Reference Level | |
| Linear Scale | Ten divisions | |
| Scale Units | dBm, dBmV, dB μ V, dB μ A, A, V, and W | |

a. 0 to -70 dB range when span = 0 Hz, or when IF Gain fixed:
(:DISPlay:WINDow:TRACe:Y[:SCALE]:LOG:RANGE:AUTO OFF).

| | Specifications | Supplemental Information |
|---|--------------------------|--------------------------|
| Marker Readout Resolution | | |
| Log scale | | |
| RBW \geq 1 kHz | | |
| 0 to -85 dB from ref level | 0.04 dB | |
| RBW \leq 300 Hz (<i>Option 1DR</i>) | | |
| 0 to -120 dB from ref level | 0.04 dB | |
| Linear scale | 0.01% of Reference Level | |

| | Specifications | Supplemental Information |
|---------------------------------------|----------------|--------------------------|
| Frequency Response^a | | |
| 50 Ω | | |
| 9 kHz to 1.5 GHz | | |
| 10 dB attenuation | | |
| 20 to 30 °C | ±0.5 dB | |
| 0 to 55 °C | ±1.0 dB | |
| 0 dB, 5 dB, 15 to 60 dB attenuation | | ±1.0 dB, characteristic |
| 75 Ω (<i>Option 1DP</i>) | | |
| 1 MHz to 1.5 GHz | | |
| 10 dB attenuation | | |
| 20 to 30 °C | ±0.5 dB | |
| 0 to 55 °C | ±1.0 dB | |
| 0, 5, 15 to 50 dB attenuation | | ±1.0 dB, characteristic |
| 55 to 60 dB attenuation | | |
| 1 MHz to 1 GHz | | ±1.0 dB, characteristic |
| 1 GHz to 1.5 GHz | | ±1.25 dB, characteristic |

a. Frequency response values are referenced to the amplitude at 50 MHz.

| | Specifications | Supplemental Information |
|--|---------------------------------------|--------------------------|
| Input Attenuation Switching Uncertainty at 50 MHz | | |
| Attenuator Setting | | |
| 0 dB to 5 dB | ±0.3 dB | |
| 10 dB | Reference | |
| 15 dB | ±0.3 dB | |
| 20 to 60 dB attenuation | ±(0.1 dB + 0.01 × Attenuator Setting) | |

| | Specifications | Supplemental Information |
|---|--|--------------------------|
| Absolute Amplitude Accuracy | | |
| At reference settings ^a | ±0.4 dB | |
| Overall Amplitude Accuracy ^b | | |
| 20 to 30 °C | ± (0.6 dB + Absolute Frequency Response) | |

- a. Settings are: reference level -25 dBm; (75 Ω reference level +28.75 dBmV); input attenuation 10 dB; center frequency 50 MHz; RBW 1 kHz; VBW 1 kHz; amplitude scale linear or log; span 2 kHz; sweep time coupled, signal at reference level.
- b. For reference level 0 to -50 dBm; input attenuation 10 dB; RBW 1 kHz; VBW 1 kHz; amplitude scale log, log range 0 to -50 dB from reference level; sweep time coupled; signal input 0 to -50 dBm; span ≤20 kHz.

| | Specifications | Supplemental Information |
|---|----------------|---|
| RF Input VSWR (at tuned frequency) | | |
| Attenuator setting | | |
| 50 Ω | | |
| 0 to 5 dB attenuation | | ≤1.55:1, characteristic |
| 10 to 60 dB attenuation | | ≤1.35:1, characteristic |
| 75 Ω | | |
| 1 MHz to 1.1 GHz | | |
| 0 to 5 dB attenuation | | ≤1.55:1, characteristic |
| 10 to 60 dB attenuation | | ≤1.35:1, characteristic |
| 1.1 GHz to 1.5 GHz | | |
| 0 to 60 dB attenuation | | ≤2.0:1, characteristic |
| Input protection is tripped | | Open input, characteristic |
| Amptd Ref is On | | Open input, characteristic |
| Auto Align All is selected | | Open input momentarily during retrace, characteristic |

| | Specifications | Supplemental Information |
|---|----------------|--------------------------|
| Auto Alignment^a Sweep-to-sweep variation | | ±0.1 dB, characteristic |

a. Set **Auto Align** to **Off** and use **Align Now, All** to eliminate this variation.

| | Specifications | Supplemental Information |
|---|----------------|--------------------------|
| Resolution Bandwidth Switching Uncertainty (at Reference Level) | | |
| 1 kHz RBW | Reference | |
| 3 kHz to 3 MHz RBW | ±0.3 dB | |
| 5 MHz RBW | ±0.6 dB | |
| 100 Hz to 300 Hz RBW (<i>Option 1DR</i>) | ±0.3 dB | |

| | Specifications | Supplemental Information |
|--|--|--------------------------|
| Reference Level | | |
| Range | -149.9 dBm to maximum mixer level + attenuator setting | |
| Resolution | | |
| Log Scale | ±0.1 dB | |
| Linear Scale | ±0.12% of Reference Level | |
| 50 Ω, Accuracy (at a fixed frequency, a fixed attenuator, and referenced to -35 dBm) | | |
| Reference Level (dBm) – input attenuator setting (dB) | | |
| -10 dBm to > -60 dBm | ±0.3 dB | |
| -60 dBm to > -85 dBm | ±0.5 dB | |
| -85 dBm to -90 dBm | ±0.7 dB | |
| 75 Ω (<i>Option 1DP</i>), Accuracy (at a fixed frequency, a fixed attenuator, and referenced to 18.75 dBmV) | | |
| Reference Level (dBmV) – input attenuator setting (dB) | | |
| 38.75 dBmV to > -11.25 dBmV | ±0.3 dB | |
| -11.25 dBmV to > -26.25 dBmV | ±0.5 dB | |
| -26.25 dBmV to -41.25 dBmV | ±0.7 dB | |

| | Specifications | Supplemental Information |
|--|-----------------------------|--------------------------|
| Display Scale Switching Uncertainty | | |
| Switching between Linear and Log | ±0.15 dB at reference level | |
| Log Scale Switching | No error | |

| | Specifications | Supplemental Information |
|---|---|--------------------------------------|
| Display Scale Fidelity | | |
| Log Maximum Cumulative | | |
| RBW \geq 1 kHz | | |
| 0 to 85 dB Below Reference Level | $\pm(0.3 \text{ dB} + 0.01 \times \text{dB from reference level})$ | |
| RBW \leq 300 Hz (<i>Option 1DR</i>) | | |
| Span > 0 Hz | | |
| Auto range On | | |
| 0 to 98 dB ^a below reference level | $\pm(0.3 \text{ dB} + 0.01 \times \text{dB from reference level})$ | |
| > 98 to 120 dB below reference level | | $\pm 2.0 \text{ dB, characteristic}$ |
| Auto range Off ^b | | |
| 0 to 60 dB ^a below reference level | $\pm(0.3 \text{ dB} + 0.015 \times \text{dB from reference level})$ | |
| > 60 to 70 dB below reference level | $\pm 1.5 \text{ dB}$ | |
| Span = 0 Hz | | |
| 0 to 60 dB ^a below reference level | $\pm(0.3 \text{ dB} + 0.015 \times \text{dB from reference level})$ | |
| > 60 to 70 dB below reference level | $\pm 1.5 \text{ dB}$ | |
| Log Incremental Accuracy | | |
| 0 to 80 dB ^{a,c} below reference level | $\pm 0.4 \text{ dB/4 dB}$ | |
| Linear Accuracy | $\pm 2\%$ of Reference Level | |

a. 0 to 30 dB for RBW = 200 Hz

b. The SCPI command for auto range off is:

(:DISPlay:WINDow:TRACe:Y[:SCALE]:LOG:RANGe:AUTO OFF)

c. 0 to 50 dB for RBWs \leq 300 Hz and span = 0 Hz, or when auto ranging is off.

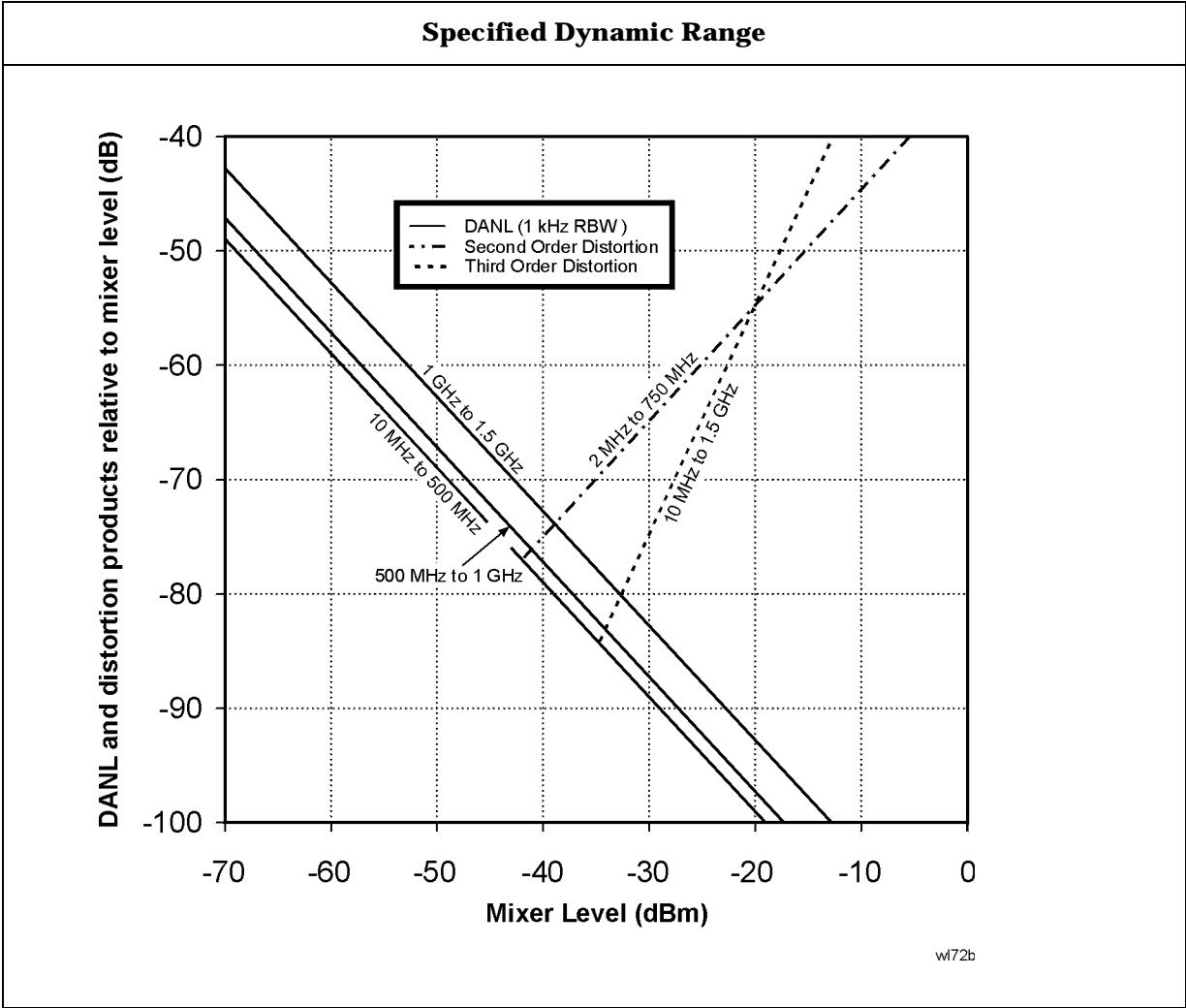
| | Specifications | Supplemental Information |
|--|---|--|
| Spurious Responses | | |
| 50 Ω | | |
| Second Harmonic Distortion | | |
| Input Signal | | |
| 2 MHz to 750 MHz | < -75 dBc for -40 dBm signal at input mixer ^a | +35 dBm SHI (second harmonic intercept) |
| Third Order Intermodulation Distortion | | |
| 2 MHz to 10 MHz | | +14.5 dBm TOI (third order intercept), typical |
| 10 MHz to 1.5 GHz | < -75 dBc for two -30 dBm signals at input mixer ^a and >50 kHz separation. | +7.5 dBm TOI |
| Other Input Related Spurious | | |
| 30 kHz ≤ offset ≤ 1200 MHz | < -65 dBc for -20 dBm signals at input mixer ^a ≤ 1.5 GHz. | |
| Offset > 1200 MHz | < -45 dBc for -20 dBm signal at input mixer ^a ≤ 1.5 GHz. | |
| Noise Floor Degradation | | |
| Input frequency = 1210.7 MHz ± RBW | | < -62 dBc for -45 dBm signal at input mixer ^a |

a. Mixer Power Level (dBm) = Input Power (dBm) – Input Attenuation (dB).

| | Specifications | Supplemental Information |
|----------------------------|---|--------------------------|
| Spurious Responses | | |
| 75 Ω, (Option 1DP) | | |
| Second Harmonic Distortion | | |
| Input signal | | |
| 2 MHz to 750 MHz | < -75 dBc for +8.75 dBmV signal at input mixer ^a | |

| | Specifications | Supplemental Information |
|---|---|--|
| Third Order Intermodulation Distortion 10 MHz to 1.5 GHz | < -75 dBc for two +18.75 dBmV signals at input mixer ^a and >50 kHz separation. | |
| Other Input Related Spurious 30 kHz \leq offset ≤ 1200 MHz | < -65 dBc for +28.75 dBmV signal at input mixer ^a ≤ 1.5 GHz. | |
| Offset > 1200 MHz | < -45 dBc, for +28.75 dBmV signal at input mixer ^a ≤ 1.5 GHz. | |
| Noise Floor Degradation Input frequency = 1210.7 MHz \pm RBW | | < -62 dBc, for +3.75 dBmV signal at input mixer ^a |

a. Mixer Power Level (dBmV) = Input Power (dBmV) – Input Attenuation (dB)



| | Specifications | Supplemental Information |
|---|---|---------------------------------|
| Residual Responses (Input terminated and 0 dB attenuation) 50 Ω 150 kHz to 1.5 GHz 75 Ω, (Option 1DP) 1 MHz to 1.5 GHz | < -90 dBm < -36 dBmV | |

Options

Tracking Generator (Option 1DN or 1DQ)

| | Specifications | Supplemental Information |
|----------------|----------------|--------------------------|
| Warm-up | 5 minutes | |

| | Specifications | Supplemental Information |
|-------------------------------|------------------|--------------------------|
| Output Frequency Range | | |
| 50 Ω (Option 1DN) | 9 kHz to 1.5 GHz | |
| 75 Ω (Option 1DQ) | 1 MHz to 1.5 GHz | |

| | Specifications | Supplemental Information |
|------------------------------|----------------|--|
| Minimum Resolution BW | 1 kHz | Not usable with resolution bandwidths ≤ 300 Hz (Option 1DR) |

| | Specifications | Supplemental Information |
|---|---------------------------|--------------------------|
| Output Power Level | | |
| 20 to 30 $^{\circ}\text{C}$ | | |
| Range | | |
| 50 Ω (Option 1DN) | 0 to -70 dBm | |
| 75 Ω (Option 1DQ) | $+42.75$ to -27.25 dBmV | |
| Resolution | 0.1 dB | |
| Absolute Accuracy (at 50 MHz with coupled source attenuator) | | |
| 50 Ω (Option 1DN) referenced to 0 dBm | ± 0.5 dB | |
| 75 Ω (Option 1DQ) referenced to $+42.75$ dBmV | ± 1.5 dB | |

| | Specifications | Supplemental Information |
|--|------------------------------------|--------------------------|
| Vernier | | |
| Range | 10 dB | |
| Accuracy (with coupled source attenuator) | | |
| 50 Ω (<i>Option 1DN</i>) referenced to 0 dBm | ±0.75 dB, for 0 to –10 dBm | |
| 75 Ω (<i>Option 1DQ</i>) referenced to 42.75 dBmV | ±0.9 dB, for +42.75 to +32.75 dBmV | |
| Output Attenuator Range | 0 to 60 dB in 10 dB steps | |

| | Specifications | Supplemental Information |
|---|----------------|---|
| Maximum Safe Reverse Level | | |
| 50 Ω (<i>Option 1DN</i>) ^a | | +20 dBm (0.1 W), 100 Vdc, characteristic |
| 75 Ω (<i>Option 1DQ</i>) ^a | | +69 dBmV (0.1 W), 100 Vdc, characteristic |

a. dc transients may trigger reverse power protection.

| | Specifications | Supplemental Information |
|----------------------------|---|--------------------------|
| Output Power Sweep | | |
| 20 to 30 °C | | |
| Range | | |
| 50 Ω (<i>Option 1DN</i>) | (–15 to 0 dBm) – (Source Attenuator Setting) | |
| 75 Ω (<i>Option 1DQ</i>) | (27.75 to 42.75 dBmV) – (Source Attenuator Setting) | |
| Resolution | 0.1 dB | |
| Accuracy (zero span) | | |
| 50 Ω (<i>Option 1DN</i>) | <1.5 dB peak-to-peak | |
| 75 Ω (<i>Option 1DQ</i>) | <1.8 dB peak-to-peak | |

| | Specifications | Supplemental Information |
|---|----------------|--------------------------|
| Output Flatness Referenced to 50 MHz, 0 dB attenuator 50 Ω (<i>Option 1DN</i>) 9 kHz to 10 MHz ± 2 dB 10 MHz to 1.5 GHz ± 1.5 dB 75 Ω (<i>Option 1DQ</i>) 1 MHz to 10 MHz ± 2.5 dB 10 MHz to 1.5 GHz ± 2 dB | | |

| | Specifications | Supplemental Information |
|---|----------------|--------------------------|
| Spurious Outputs 50 Ω (<i>Option 1DN</i>) (0 dBm output) 75 Ω (<i>Option 1DQ</i>) (+42.75 dBmV output) Harmonic Spurs 9 kHz to 20 MHz < -20 dBc 20 MHz to 1.5 GHz < -25 dBc Non-harmonic Spurs < -35 dBc | | |

| | Specifications | Supplemental Information |
|----------------------|---|--------------------------|
| Dynamic Range | Maximum Output Power Level – Displayed Average Noise Level | |

| | Specifications | Supplemental Information |
|---|----------------|--|
| Output Tracking Drift Swept Tracking Error | | No error No error for coupled sweep times |

| | Specifications | Supplemental Information |
|---|----------------|---|
| RF Power-Off Residuals 50 Ω (Option 1DN) 100 kHz to 1.5 GHz 75 Ω (Option 1DQ) 1 MHz to 1.5 GHz | | < -120 dBm, characteristic < 65 dBmV, characteristic |

| | Specifications | Supplemental Information |
|--|----------------|--------------------------|
| Output Attenuator Repeatability | | ±0.2 dB, characteristic |

| | Specifications | Supplemental Information |
|--|----------------|--|
| Output VSWR 50 Ω (Option 1DN) 75 Ω (Option 1DQ) | | <2.5:1, characteristic <2.0:1, characteristic |

| | Specifications | Supplemental Information |
|---|----------------|--|
| Output Attenuator Accuracy 0 dB 10 dB 20 dB 30 dB 40 dB 50 dB 60 dB | Reference | ±0.6 dB, characteristic ±0.9 dB, characteristic ±1.2 dB, characteristic ±1.5 dB, characteristic ±1.8 dB, characteristic ±2.1 dB, characteristic |

| |
|--|
| Tracking Generator Output Accuracy 50 Ω (Option 1DN) |
| Relative Accuracy (Referred to 0 dBm) = Output Attenuator Accuracy + Vernier Accuracy + Output Flatness |
| Absolute Accuracy = Relative Accuracy (Referred to 0 dBm) + Absolute Accuracy at 50 MHz |

| |
|--|
| Tracking Generator Output Accuracy 75 Ω (Option 1DQ) |
| Relative Accuracy (Referred to +42.75 dBmV) = Output Attenuator Accuracy + Vernier Accuracy + Output Flatness |
| Absolute Accuracy = Relative Accuracy (Referred to +42.75 dBmV) + Absolute Accuracy at 50 MHz |

General

| | Specifications | Supplemental Information |
|--------------------------|----------------|--------------------------|
| Temperature Range | | |
| Operating | 0 to 55 °C | Floppy disk 10 to 40 °C |
| Storage | -40 to 75 °C | |

| | Specifications | Supplemental Information |
|---------------------------------|----------------|----------------------------|
| Audible Noise (ISO 7779) | | |
| Sound Pressure at 25 °C | | <40 dBa, (<4.6 Bels power) |

| | Specifications | Supplemental Information |
|-------------------------------|---|--------------------------|
| Military Specification | Has been type tested to the environmental specifications of MIL-PRF-28800F class 3. | |

| | Specifications | Supplemental Information |
|--------------------------|---|--------------------------|
| EMI Compatibility | Conducted and radiated emission is in compliance with CISPR Pub. 11/1990 Group 1 Class A. | |

| | Specifications | Supplemental Information |
|-------------------------|----------------|---|
| Immunity Testing | | |
| Radiated Immunity | | Testing was done at 3 V/m according to IEC 801-3/1984. When the analyzer tuned frequency is identical to the immunity test signal frequency, there may be signals of up to -60 dBm displayed on the screen. |
| Electrostatic Discharge | | Air discharges of up to 8 kV were applied according to IEC 801-2/1991. Discharges to center pins of any of the connectors may cause damage to the associated circuitry. |

| | Specifications | Supplemental Information |
|----------------------------|--|--------------------------|
| Power Requirements | | |
| ac Operation | | |
| Voltage, frequency | 90 to 132 Vrms, 47 to 440 Hz 195 to 250 Vrms, 47 to 66 Hz | |
| Power Consumption, On | <300 W | |
| Power Consumption, Standby | <5 W | |
| dc Operation | | |
| Voltage | 12 to 20 Vdc | |
| Power Consumption | <200 W | |
| Power Consumption, Standby | <100 mW | |

| | Specifications | Supplemental Information |
|---|----------------|--------------------------|
| Measurement Speed | | |
| Local Measurement and Display Update rate ^{a,b} | | ≥ 35/s, characteristic |
| Remote Measurement and GPIB Transfer Rate ^{b,c,d} (Option A4H) | | ≥ 30/s, characteristic |
| RF Center Frequency Tune, Measure, and GPIB Transfer Time ^{b,c,e} (Option A4H) | | ≤ 90 ms, characteristic |

- a. Factory preset, auto align Off, fixed center frequency, RBW = 1 MHz, and spans >102 MHz and ≤400 MHz.
- b. Sweeping through 425.6 MHz or 914.6 MHz will cause the measurement speed to degrade.
- c. Display Off (:DISPlay:ENABle OFF), and 32-bit integer data format (:FORMat:DATA INT,32), if *Option A4J* is installed, disable sweep ramp, (:SYS-Tem:PORTs:IFVSweep:ENABle OFF), markers off, single sweep, measured with IBM compatible PC with 550 MHz Pentium® III running Windows® NT 4.0, one meter GPIB cable, National Instruments PCI-GPIB card and NI-488.2 DLL.
- d. Factory preset, auto align Off, RBW = 1 MHz, span= 20 MHz, fixed center frequency, average of 100 measurements.
- e. Factory preset, auto align Off, RBW = 1 MHz, span= 20 MHz, and center frequency tune step size = 50 MHz.

| | Specifications | Supplemental Information |
|---------------------------|----------------|---|
| Data Storage | | |
| Internal ^a | | 8.0 MB, nominal |
| External (10 to 40 °C) | | 3.5" 1.44 MB, MS-DOS [®] compatible floppy disk |

a. For serial numbers prior to US41440000 or MY41440000, 1 MB without Option B72, 8 MB with Option B72.

| | Specifications | Supplemental Information |
|------------------------------------|----------------|------------------------------|
| Memory Usage | | |
| State | | 20 kB ^a , nominal |
| State plus 401-point trace | | 21 kB ^a , nominal |
| Applications memory usage | | |
| 8590 Compatibility (Option 290) | | 0.7 MB, nominal |

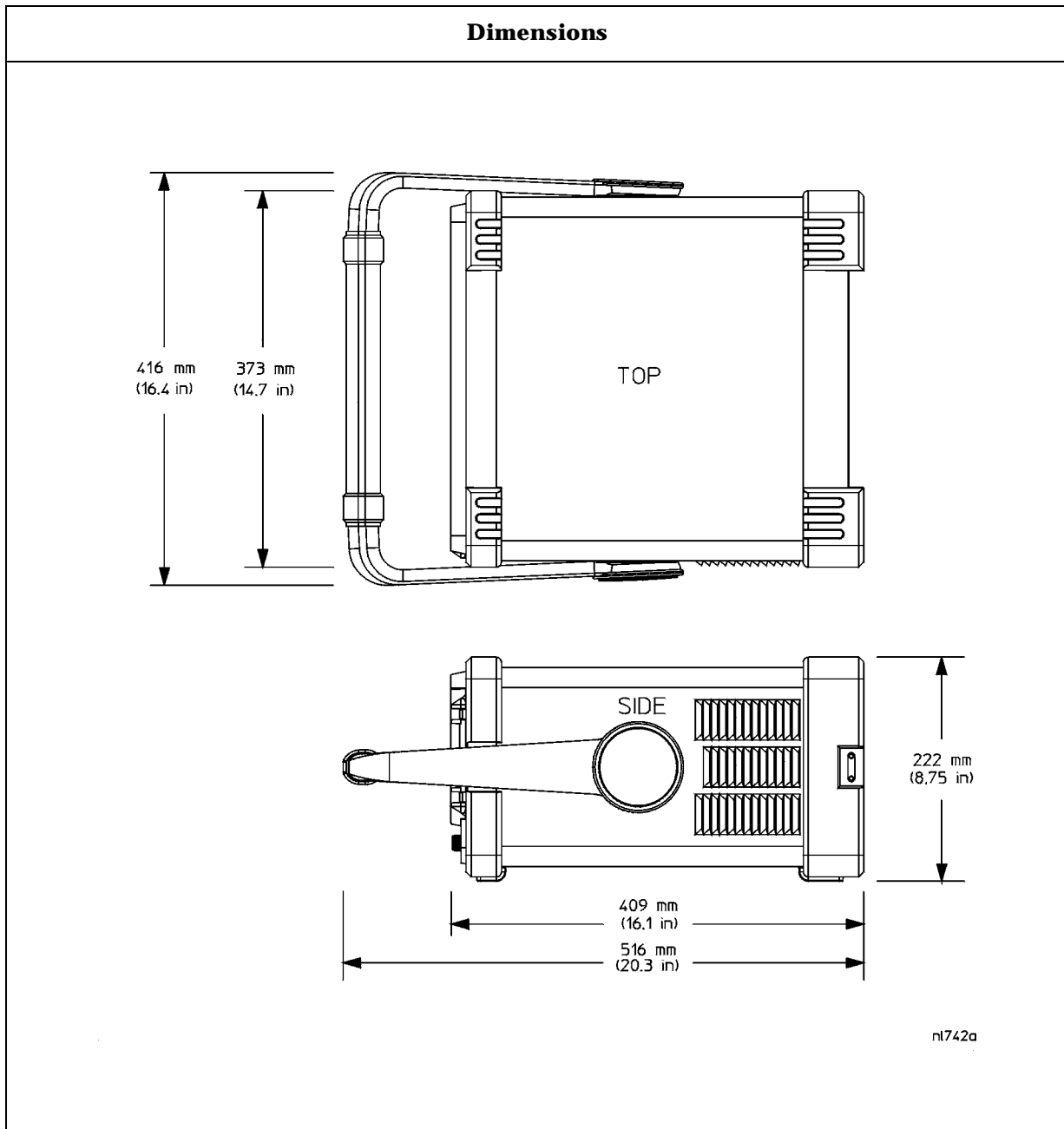
a. The size of state will increase depending on installed applications.

| | Specifications | Supplemental Information |
|------------------------------|----------------|---|
| Demod Tune and Listen | | |
| Demod (Option A4J) | AM | Internal speaker, front-panel earphone jack and front-panel volume control. An uncalibrated demodulated signal is available on the AUX VIDEO OUT connector at the rear panel. |

| | Specifications | Supplemental Information |
|---------------------------------|----------------|--------------------------------------|
| Weight (without options) | | |
| Net | | 13.2 kg (29.1 lb), characteristic |
| Shipping | | 25.1 kg (55.4 lb), characteristic |

| | Specifications | Supplemental Information |
|----------------------------|----------------|--------------------------|
| Display^a | | |
| Resolution | 640 × 480 | |

a. The LCD display is manufactured using high precision technology. However, there may be up to six bright points (white, blue, red or green in color) that constantly appear on the LCD screen. These points are normal in the manufacturing process and do not affect the measurement integrity of the product in any way.



Inputs and Outputs

Internal

| | Specifications | Supplemental Information |
|--------------------------------------|----------------|--|
| Amptd Ref^a | | Amplitude reference |
| Frequency | | 50 MHz |
| Frequency Accuracy | | Frequency reference error ^b |
| 50 Ω Amplitude | | -25 dBm ^c , nominal |
| 75 Ω Amplitude (<i>Option 1DP</i>) | | +28.75 dBmV ^c , nominal |

- a. Turn the amplitude reference signal on/off by pressing the keys: **Input/Output**, **Amptd Ref**.
- b. Frequency reference error = (aging rate × period of time since adjustment + settability + temperature stability).
- c. The internal amplitude reference actual power is stored internally.

Front Panel

| | Specifications | Supplemental Information |
|---------------------------------------|----------------|--------------------------|
| INPUT 50 Ω | | |
| Connector | Type-N female | |
| Impedance | | 50 Ω, nominal |
| INPUT 75 Ω (<i>Option 1DP</i>) | | |
| Connector | BNC female | |
| Impedance | | 75 Ω, nominal |

| | Specifications | Supplemental Information |
|---|----------------|--------------------------|
| RF OUT 50 Ω, (<i>Option 1DN</i>) | | |
| Connector | Type-N female | |
| Impedance | | 50 Ω, nominal |
| RF OUT 75 Ω, (<i>Option 1DQ</i>) | | |
| Connector | BNC female | |
| Impedance | | 75 Ω, nominal |

| | Specifications | Supplemental Information |
|---------------------------------------|----------------|--|
| PROBE POWER Voltage/Current | | +15 Vdc, $\pm 7\%$ at 150 mA max., characteristic -12.6 Vdc $\pm 10\%$ at 150 mA max., characteristic |

| | Specifications | Supplemental Information |
|--|------------------------|---|
| EXT KEYBOARD^a Connector | 6-pin mini-DIN | Used for entering screen titles and filenames only. Interface compatible with most IBM-compatible PC keyboards. |

a. The feature is not implemented in firmware revisions prior to A.04.00.

| | Specifications | Supplemental Information |
|----------------|----------------|----------------------------------|
| Speaker | | Front panel knob controls volume |

| | Specifications | Supplemental Information |
|---|--|--|
| Headphone Connector Power Output | 3.5 mm (1/8 inch) miniature audio jack | Front panel knob controls volume 0.2 W into 4 Ω , characteristic |

Rear Panel

| | Specifications | Supplemental Information |
|---|----------------|---|
| 10 MHz REF OUT Connector Impedance Output Amplitude | BNC female | 50 Ω , nominal >0 dBm, characteristic |

| | Specifications | Supplemental Information |
|-----------------------|-----------------------|---|
| 10 MHz REF IN | | |
| Connector | BNC female | Note: Analyzer noise sidebands and spurious response performance may be affected by the quality of the external reference used. |
| Impedance | | 50 Ω , nominal |
| Input Amplitude Range | | -15 to +10 dBm, characteristic |
| Frequency | | 10 MHz, nominal |

| | Specifications | Supplemental Information |
|------------------------------|-----------------------|---|
| GATE TRIG/EXT TRIG IN | | |
| Connector | BNC female | |
| External Trigger Input | | |
| Trigger Level | | Selectable positive or negative edge initiates sweep in EXT TRIG mode (5 V TTL) |

| | Specifications | Supplemental Information |
|------------------------|-----------------------|---|
| GATE/HI SWP OUT | | |
| Connector | BNC female | |
| High Sweep Output | | |
| Level | | High = sweep ^a ; Low = retrace (5 V TTL) |

a. High sweep may be high longer than the indicated sweep times.

| | Specifications | Supplemental Information |
|-------------------|-----------------------------------|---|
| VGA OUTPUT | | |
| Connector | VGA compatible, 15-pin mini D-SUB | |
| Format | | VGA (31.5 kHz horizontal, 60 Hz vertical sync rates, non-interlaced) Analog RGB |
| Resolution | 640 \times 480 | |

| | Specifications | Supplemental Information |
|--|----------------|---------------------------------------|
| AUX IF OUT <i>(Option A4J)</i> | | RBW \geq 1 kHz |
| Connector | BNC female | |
| Frequency | | 21.4 MHz, nominal |
| Amplitude (for signal at reference level and for reference levels – input attenuation of –10 to –70 dBm) | | –10 dBm (uncorrected), characteristic |
| Impedance | | 50 Ω , nominal |

| | Specifications | Supplemental Information |
|---|----------------|--|
| AUX VIDEO OUT <i>(Option A4J)</i> | | RBW \geq 1 kHz |
| Connector | BNC female | |
| Amplitude Range (into >10 k Ω) | | 0 to 1 V (uncorrected), characteristic |

| | Specifications | Supplemental Information |
|---|----------------|--|
| HI SWP IN <i>(Option A4J)</i> | | |
| Connector | BNC female | |
| Input | | Open collector, low resets and holds the sweep (5 V TTL) |

| | Specifications | Supplemental Information |
|--|----------------|---|
| HI SWP OUT <i>(Option A4J)</i> | | |
| Connector | BNC female | |
| Output | | High = sweep ^a , Low = retrace (5 V TTL) |

a. High sweep may be high longer than the indicated sweep times.

| | Specifications | Supplemental Information |
|---------------------------------------|----------------|--------------------------|
| SWP OUT <i>(Option A4J)</i> | | |

| | Specifications | Supplemental Information |
|------------------------|-----------------------|------------------------------------|
| Connector Amplitude | BNC female | 0 to +10 V ramp, characteristic |

| | Specifications | Supplemental Information |
|---|------------------------|---|
| GPIB Interface <i>(Option A4H)</i> Connector GPIB Codes | IEEE-488 bus connector | SH1, AH1, T6, SR1, RL1, PP0, DC1, C1, C2, C3 and C28 |

| | Specifications | Supplemental Information |
|---|-----------------------|---------------------------------|
| Serial Interface <i>(Option 1AX)</i> Connector | 9-pin D-SUB male | RS-232 |

| | Specifications | Supplemental Information |
|--|-----------------------|---------------------------------|
| Parallel Interface <i>(Option A4H or 1AX)</i> Connector | 25-pin D-SUB female | Printer port only |

Regulatory Information

CAUTION

This product is designed for use in Installation Category II and Pollution Degree 2 per IEC 1010 and 664 respectively.

NOTE

This product has been designed and tested in accordance with IEC Publication 1010, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the product in a safe condition.



The CE mark is a registered trademark of the European Community (if accompanied by a year, it is the year when the design was proven).




The CSA mark is the Canadian Standards Association safety mark.

ISM 1-A

This is a symbol of an Industrial Scientific and Medical Group 1 Class A product. (CISPR 11, Clause 4)

Declaration of Conformity

| DECLARATION OF CONFORMITY | |
|---|---|
| According to ISO/IEC Guide 22 and CEN/CENELEC EN 45014 | |
| Manufacturer's Name: | Agilent Technologies, Inc. |
| Manufacturer's Address: | 1400 Fountaingrove Parkway Santa Rosa, CA 95403-1799 USA |
| Declares that the products | |
| Product Name: | Spectrum Analyzer |
| Model Number: | E4401B, E4402B, E4403B, E4404B, E4405B, E4407B, E4408B, E4411B |
| Product Options: | This declaration covers all options of the above products. |
| Conform to the following product specifications: | |
| EMC: IEC 61326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998 | |
| <u>Standard</u> | <u>Limit</u> |
| CISPR 11:1990 / EN 55011-1991 | Group 1, Class A |
| IEC 61000-4-2:1995+A1998 / EN 61000-4-2:1995 | 4 kV CD, 8 kV AD |
| IEC 61000-4-3:1995 / EN 61000-4-3:1995 | 3 V/m, 80 - 1000 MHz |
| IEC 61000-4-4:1995 / EN 61000-4-4:1995 | 0.5 kV sig., 1 kV power |
| IEC 61000-4-5:1995 / EN 61000-4-5:1996 | 0.5 kV L-L, 1 kV L-G |
| IEC 61000-4-6:1996 / EN 61000-4-6:1998 | 3 V, 0.15 – 80 MHz |
| IEC 61000-4-11:1994 / EN 61000-4-11:1998 | 1 cycle, 100% |
| Safety: IEC 61010-1:1990 + A1:1992 + A2:1995 / EN 61010-1:1993 +A2:1995 CAN/CSA-C22.2 No. 1010.1-92 | |
| Supplementary Information: The products herewith comply with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC and carry the CE-marking accordingly. | |
|  | |
| Santa Rosa, CA, USA | 17 April 2000 |
| Greg Pfeiffer/Quality Engineering Manager | |
| For further information, please contact your local Agilent Technologies sales office, agent or distributor. | |